



BEHAVIOURAL RESEARCH IN OFFICE COMMUNICATIONS

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The design of user manuals for office systems
a review of the literature

OFFICE COMMUNICATIONS SYSTEMS PROGRAM



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THE DESIGN OF USER MANUALS FOR OFFICE SYSTEMS:
A REVIEW OF THE LITERATURE

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Behavioural Research in Office Communications 1
The Design of User Manuals for Office Systems: A Review of the Literature

Some people have expressed the hope that office communications systems will be so easy to learn and to use, so "user-friendly", that no documentation on paper will be required. This report shows that there is a current need for paper documentation, and it assumes that paper documentation will be required for the foreseeable future.

The authors have not provided guidelines for preparing technical documents. They report that it is too soon to do so because there are many unanswered questions and writing guidelines now might inhibit research or inhibit the entry of new research findings into general practice. What the authors have provided has both practical application and relevance to research.

Technical writers, editors and publishers will find this report useful as a reference. It outlines the issues they should consider in order to prepare good documentation and it directs them to the relevant books and articles about these issues. The authors report that documentation written recently for the user who has little computer background is generally perceived as suboptimal. The report suggests some reasons. The people who write technical documents receive little or no specific training for their jobs; however, there are few sources of such training. There is little effort devoted to testing of documentation with end users; however, procedures and methods for testing are poorly developed and there is no pressure from purchasers to see the results of such testing before they buy. The authors make recommendations toward redressing these problems.

Researchers from many disciplines, including psychology, education, linguistics, typography and computer science, will find in this report both documentation of the questions that are at the leading edge and a cogent discussion of methods and strategies for making research relevant to the practical concerns.

Research will also be important as we move toward publishing electronically. Many of the research questions mentioned in the report deal with how to present information so the user can learn quickly, for example, how to use diagrams, graphs and tables for learning. The answers to these questions will also be important for the development of computer-assisted learning packages which may accompany or replace manuals in the future. Some research findings, such as those in typography and layout, may not transfer directly to the new medium and will have to be checked to see if they still apply to electronic publishing.

The authors recommend further research and have directed attention to the areas of most need. The Department of Communications is taking the first steps in responding to these recommendations by publishing this report.

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INTRODUCTION

The quality of manuals describing the use of computerised office equipment has a substantial impact upon sales and successful use of such systems. Yet, many small, technologically advanced Canadian firms lack the internal expertise to produce high quality documentation and are further handicapped by the lack of available guidelines for manual development.

This report addresses the possibility of providing guidelines on documentation to Canadian manufacturers of office automation equipment and systems. It is not the purpose of the report to provide guidelines. Instead, the report makes recommendations concerning the development of guidelines which should be based on information gathered in a survey of the relevant literature, and on an appraisal of existing documents, practices, and user concerns. To this end, the report consists of four parts: a survey of the literature; a survey of documents, document users and suppliers; a set of recommendations concerning the possible involvement of the Department of Communications in supporting research or information distribution in this area; and an annotated bibliography.

The literature review on documentation-related issues and the annotated bibliography cover the literature through March 1982, and are intended to provide a starting point for a researcher interested in exploring one or more of the many issues concerned with documentation for end users, and to give practitioners an idea of where to find currently available information concerning guidelines. An effort was made to include as many of the recent review articles as possible on topics which would be relevant to documentation, and to include original articles concerned with guidelines, training manuals, documentation preparation, management techniques, evaluation of documents, and research methods. In studying document preparation techniques, the variety of sources in which relevant information can be found is large and the number of individual studies is immense. Individual studies are typically included in the review only if they met at least one of three criteria: 1) they are too recent to be included in a review; 2) they have direct relevance to document preparation; 3) they provide a discussion of methods or guidelines having unique characteristics not well represented in the reviews.

While considerable effort has been made to discover major reviews, the fact that the information is scattered throughout the educational, psychological, computer science, technical writing and linguistics literatures makes us less than confident that we have found all of the relevant material.

Interviews with technical writers and end users of documentation were conducted to determine whether a need for guidelines was perceived by either group, and particularly to find out what sorts of questions technical writers had about preparation of materials. A lack of a perceived need by either the producers or the users would influence recommendations about possible Department of Communications action.

REVIEW OF THE LITERATURE

OVERVIEW

This literature review is divided into three major sections. The first focuses on the manuals themselves -- characteristics of the content and layout of technical material. The second major topic focuses on the production of manuals, with emphasis upon management of document production, and the skills and information required by technical writers. Finally, research methodology is considered, including techniques designed to provide guidelines on documentation preparation, and techniques for evaluating manuals.

Throughout this paper, an effort has been made to indicate recent reviews of an area, the general nature of the research questions addressed, and to provide more detailed consideration of any topics representing new research directions which are not well covered by the reviews. For more details on a particular topic, the reader can use the subject index to locate a wider selection of articles.

CONTENT OF DOCUMENTS

SEQUENCING

Sequencing is concerned with the order of presentation of ideas and concepts. Sequencing encompasses the order of ideas in sentences (Marshek, 1975), in a paragraph (e.g. Kieras, 1978), the ordering of paragraphs (Colby, 1977), the transition from paragraph to paragraph (Marshek, 1975), and the general plan for ordering concepts in a document (e.g. Posner & Strike, 1976). It is generally accepted that paragraphs should start with a topic sentence and contain a number of sentences on that topic, with each sentence adding to or modifying a previous sentence. Kieras (1978) demonstrates the detrimental effect of violation of this convention on reading time, recall, and comprehension of paragraphs. Colby (1977) and Marshek (1975) discuss ways to link paragraphs together. Posner and Strike (1976) acknowledge that no firm rules for how to order thoughts can be applied to all situations. They feel that each situation will have to be analysed, and to help with this process, they provide a list of different ways sequencing can effectively be handled. Unfortunately, their descriptions of the types of sequences are rather abstract, and expressed in technical jargon. Their examples often do not aid in the understanding of the types of sequencing. Walker and Meyer (1980) review three comprehensive theories of memory in the context of sequencing issues. They conclude that material should be ordered differently depending on whether the goal is to integrate (show what is similar at the expense of differences) or segregate (emphasize the differences at the expense of similarities). A different approach in understanding the sequencing issue is provided by McConkie (1978). McConkie adopts a psycholinguistic view of sequencing and reviews a number of studies that attempt to determine the effect of sequencing on recall. The results indicate tremendous variability among subjects with, for a variety of sequencing techniques,

better organized material resulting in better recall.

Concern with the sequencing of material has been at the heart of research on individualized instruction and computer aided learning. This literature is too large to review here. Briggs (1968) and Davies (1972) provide a review of some issues related to sequencing from the field of education. Horn and Kelly (1981) describe the structured writing approach to documentation. This approach, which grew out of modern computer science practices, emphasizes systematic analysis of what is to be said and a formal, but simple, way of presenting the material. They provide a series of examples that compare the structured approach to sequencing and layout with more common approaches.

A very important aspect of sequencing that is often overlooked is the inclusion of a table of contents, an index and a glossary, as well as other "sign posts." Grimm (1981), Martin (1981), and Pakin (1981) emphasize the importance of these techniques for guiding the user through the document on first reading and for finding information later. Other sign posts include chapter titles, section headings and subheadings, and tabs to separate sections in a large document. Many documents either do not include table of contents, index and glossary, or, if included, these sections are poorly done. Since most documents serve an initial teaching function and a long term reference function, these organizational techniques are extremely important.

USE OF ADJUNCT AIDS

Adjunct aids are supplements to prose, rather than replacements for prose. They are designed to facilitate learning of the information contained in the text. In general, the type of learner, the material, and the nature of the learning task all influence the effectiveness of a given aid. Learners vary in terms of ability and previous knowledge of the content. The material may be intended to promote understanding of principles, provide step by step instructions for routine activities, or present facts and details. Learning tasks sometimes require memorizing and faithfully reproducing the information presented. At other times, the criterion of interest is the ability to follow the instructions without error, the ability to correctly transfer what has been learned to new tasks or to reach a logical conclusion on the basis of the material. Thus, the major criterion for judging the effectiveness of the adjunct aid depends on its intended effect. Some of the contradictory evidence in research concerned with adjunct aids comes from utilizing different types of measures to evaluate their effectiveness. All of the adjunct aid strategies have been shown to be effective in some circumstances, but not others. The better review articles attempt to determine the sources of variance most plausibly associated with success.

Hartley and Davies (1976) have written a review of pre-instructional aids -- aids which precede the prose -- which attempts to identify the conditions under which the aids are successful. The adjunct aids they cover are pretests, behavioural objectives, overviews and advance

organizers.

Pretests and behavioural objectives

Both pretests and behavioural objectives precede the material to be learned. Pretests are phrased as questions while behavioural objectives are simple statements of what the student is expected to be able to accomplish after studying the material. Pretests and behavioural objectives have been extensively studied, with highly mixed results. Pretests seem more likely to be effective when the lesson to be learned is short, the learners are generally familiar with the content and there is a need to alert them as to what they do not know. Behavioural objectives are more effective when the learners need to be alerted as to what they should accomplish, particularly when the material is unstructured. Some researchers consider behavioural objectives to be functionally equivalent to pretests in defining what a student needs to learn. These aids will be covered more fully in a later section dealing with the use of questions.

Overviews

Overviews, summaries of the material presented prior to the lesson, have not received a great deal of experimental attention in the educational literature although they are widely used in textbooks. "The idea that overviews are worthwhile seems to be so obvious that few people have felt any real need to subject the concept to empirical investigation" (Hartley & Davies, 1976, p. 251). Those investigations which have looked at overviews have tended to indicate that an overview facilitates performance relative to no overview.

Advance organizers and models

The fourth type of pre-instructional strategy covered in the Hartley and Davies review are advance organizers. Advance organizers, like overviews, precede the text to which they refer. However, unlike an overview, they attempt to provide a context for the material to be learned by relating it to knowledge which the learner already has. In addition, the organizer should indicate differences between new material and old. When the new material can be related to previously learned ideas, the organizer is used to provide "ideational scaffolding for the specifics in the learning passage" (Ausubel, 1978, p. 253). As an example, an advance organizer to prepare the user to learn a number of commands for storing and retrieving files from a floppy disk might make a comparison between information on a disk and recordings on a record, pointing out both similarities and differences. Currently, research is directed at determining the value of advance organizers for teaching inexperienced persons to use computers and calculators. The original work on advance organizers was undertaken by Ausubel and his associates in the 1960s. A comprehensive treatment of that work can be found in his 1968 textbook.

A recent paper by Mayer (1979a) summarizes the major conditions under which advance organizers are most effective. According to Ausubel's and

Mayer's theories, advance organizers should only be effective if subjects do not already have and make use of an appropriate conceptual model for studying the new material. "Thus, the best test of advance organizers occurs when material is unfamiliar, technical or otherwise difficult for the learner to relate to his or her existing knowledge" (Mayer, 1979a, p. 372). In addition, advance organizers are expected to aid in integrating the fundamental ideas with existing knowledge at the expense of minor details. Because of this trade-off, he predicts that transfer tasks, not retention tasks, should be used to show positive effects of advance organizers. In general, the results support these predictions.

Mayer (1975) is primarily responsible for applying the advance organizer idea to the problem of conveying an appropriate conceptual model to novice computer users. This need for a correct conceptual model is well documented. Lewis and Mack (1982) provide some interesting examples of the errors committed by new users as a result of inappropriate models.

In a series of articles, Mayer (1975, 1979a, 1979b, 1980, 1981) has presented considerable evidence that advance organizers do help novice programmers when transfer is measured. Additionally, he has attempted to form explicit techniques for developing advance organizers. To become familiar with the work of Mayer and associates, two of his papers are particularly helpful in providing an overview of the theory, findings, and techniques for creating advance organizers (Mayer, 1981; and Mayer & Bromage, 1980).

Generally, two types of advance organizers have been used to provide users with useful conceptual models: analogies and special models. "Think of the computer as a typewriter" is an example of an analogy. The use of such analogies has been advocated by Rumelhart and Norman (1981). However, Halasz and Moran (1982) have cautioned that new learners should not be encouraged to use such analogies to reason about how the system works. They argue that there are always important differences between the computer system and the analogy. Thus, naive users trying to decide what to do by considering what they would do in the analogous case would often make incorrect judgments.

Much of the current work is focused upon developing conceptual models which are appropriate representations of the system which the user needs to learn. The properties of these models which will make them effective for users is not yet well understood, and a variety of techniques are being tried. (See DuBoulay, et al., 1981; Lawson, 1981; Mayer, 1979a; Rumelhart & Norman, 1981, and Young, 1981, for examples of models.)

Questions as adjunct aids

The inclusion of questions which do not present new material, but which require recall or use of previously presented material is a common adjunct aid. Along with the Hartley and Davies (1976) review of pretests and behavioural objectives, there are two very recent reviews concerned with the usefulness of questions as adjunct aids (Andre, 1979 and Rickards,

1979). As pointed out by Rickards, work on questions as adjunct aids started under the neobehaviouristic tradition in which the main emphasis was on use of the questions to reinforce learning or as discriminative cues to guide further studying. In such studies, the ability to remember both intentional and incidental passages is measured. Intentional passages are those covering material for which a question is asked as part of the lesson. Incidental passages are those for which no question is asked. The adjunct questions are sometimes placed before, in or after the text being read. Much of the earlier work attempted to evaluate the effect of parameters such as the frequency, location and number of questions. The type of question, type of material and characteristics of the learner were typically ignored in these studies. Currently, influenced by depth of processing models, there is an interest in the type of question used as an adjunct aid (Andre, 1979). Most of the older studies (and most current manuals which utilize questions) use questions which simply require factual recall of the passage. Recently, interest has focused on higher order questions, or inference questions. Higher order questions, such as application questions, require students to select a new example of an idea; inference questions require students to describe an implied but not stated relationship (Andre, 1979). One function of the use of questions, and most other forms of adjunct aids, seems to be attentional in nature. The questions call attention to material that the reader must learn. This view is supported by results that indicate performance will be facilitated when the performance test requires the same answers as the adjunct questions. Otherwise, performance may be degraded. Higher level questions, according to Andre, may improve performance simply by signaling to the learner that he must attend to more information. Those studies which have used higher level questions about concepts and principles as adjunct aids found transfer to other problems involving those same concepts, but not to other concepts and principles. If these findings are found to hold true for questions used in manuals, several conclusions can be drawn. 1) If questions are used, they must be very carefully selected to call attention to all of the types of performance the learner will be required to have. 2) Use of only factual questions for learners who have to apply their learning may be harmful. 3) If a high degree of transfer of concepts is called for under a large variety of conditions, advance organizers may be more effective than questions.

It should be noted that the attentional effect of questions is not the only variable to be considered. Andre mentions the difficulty level of the questions and the ability level of the learner and the learner's perception of the task demands as three additional important variables. Finally, Moeser (1978) has done a series of experiments to show that the placement of questions within the text is an important parameter. When the questions break the natural flow of the text, by interrupting the development of an episode or idea, they actually degrade memory for the material, while appropriately positioned questions do not.

The effectiveness of adjunct questions appears to depend primarily upon using questions which are truly representative of the learning task. It is much easier to design questions for content than for higher cognitive

tasks. Thus, manual designers should include adjunct questions with great care based on a clear understanding of the knowledge needed. The best review of this literature is the Andre (1979) article.

USE OF ILLUSTRATIONS

While illustrations can be considered as adjunct aids, the research literature does not include them under that topic, so they will be considered as a separate topic.

There have been four recent reviews of the literature on illustrations in text. Duchastel (1980), Brody (1981) and Macdonald-Ross (1978) have all considered the use of illustrations in textbooks, while Moore and Nawrocki (1978) attempted to survey the use of graphics in computer assisted instruction. All but Macdonald-Ross conclude that research has not led to the development of guidelines and that the conditions under which illustrations are useful are not well understood. The review by Macdonald-Ross is concerned explicitly with technical drawings and attempts to provide guidelines and advice for graphic designers.

All of the authors point to a need for more systematic research. They feel that some of the confusion results from asking research questions too broadly. The question of whether pictures work or not needs to be narrowed. More appropriate research would focus on a particular picture type (for example, a tree diagram) and a specific type of task (for example, learning to find information in a hierarchy). While the term "illustration" is somewhat more specific than the term "picture", it can refer to photographs, drawings, graphs and maps. In addition the function and physical properties of illustrations can vary. Duchastel (1980) refers to the role of illustrations as being attentional, explicative, and/or retentional. He feels that a distinction based on function will be more useful than more traditional taxonomies based on physical properties, such as number of colors, amount of realism, etc. "Type of content should be considered; some materials do not need explicative illustrations to be understood, while others most certainly do (p. 285)". Macdonald-Ross also suggests a functional taxonomy of technical diagrams into four types: 1) those which show an object and identify key parts; 2) those which help the reader perform a well defined task; 3) those which are used for explanation by showing logical relationships; and 4) those which display data. Information on the first and second types will be considered jointly, then work in the other two areas will be described.

Diagrams related to identifying parts and illustrating how to perform a task

The small number of experiments which have utilized illustrations or drawings to facilitate instructing individuals to perform tasks have tended to show that illustrations are a useful supplement to prose, but not substitutes for prose. Stone and Glock (1981) gave written instructions, diagrams, or instructions plus diagrams on how to assemble a cart. Booher (1975) showed subjects how to operate a panel of switches and indicators

with various combinations of text and illustrations. Both found increased speed with illustrations alone, but also increased errors. Use of both text and illustrations resulted in the best combination of speed and accuracy. There is also growing evidence that small variations in the presentation of graphic instructions have a great influence on error rates. For example, both the Booher (1975) article and a study by Szlichcinski (1980) show that small variations in the placement of an arrow indicating that a switch should be thrown lead to differences in performance. In addition, Marcel and Barnard (1977) showed that an illustration of the whole apparatus in the instruction led to much lower error rates than an illustration of only the parts currently involved in the operation. Use of diagrams to supplement prose is common in presenting aids to workers who perform tasks associated with complex equipment. These diagrams range in format from photographs and drawings to functional block diagrams to algorithms. According to Macdonald-Ross (1977), task analysis should be used to determine the content and purpose of the diagrams. However, Macdonald-Ross claims that careful task analysis, which was part of the early highly successful use of technical diagrams in United States Armed Forces research, is being de-emphasized today. "Other organizations have since copied the form of the graphics without achieving the quality of analysis that made the graphic aids effective. Organizations that use job-support documentation should realize that the documentation rests absolutely on the quality of prior analysis; it is no use expecting a technical document department to produce effective material if it is not supported by top-class analysis" (Macdonald-Ross, p. 72).

Use of algorithms to describe procedures appears to be popular when there are a number of decisions which must be made in following a course of action. Algorithms use noncontinuous prose, in the form of flowcharts, logical trees, lists or structured writing. These forms allow the user to deal with a single decision rule at each step. There is evidence that these forms are more effective than prose in helping a user follow branching instructions, but there is little comparison among various types. Blaiwes (1974) has shown that the logical tree format is superior to lists of short sentences for complex tasks (particularly when there were a number of choices at each choice point). Horn and Kelly (1981) review the literature on structured writing and provide several examples. They define structured writing as "different properties of text that permit the structure of the subject matter and the document to be perceived by the reader" (p. 9). It is a standardized approach in which paragraphs are replaced by labelled blocks of information which are grouped into higher order groupings called maps. The approach is of particular interest to technical writers in charge of computer documentation for end users. Research showing the benefits of structured writing is fairly limited due to the recent development of the technique.

Use of diagrams for explanation

While a small amount of evidence exists to show that illustrations, when accompanied by text, aid in presenting instructions, there is little research, and no clear evidence, to show that illustrations are effective

as advance organizers or in other expository roles. The utility of diagrams for this purpose is largely assumed. For example, a great deal of the work on advance organizers and use of concrete models for computer systems makes use of diagrams when presenting the models. This is true for Mayer's transactions (e.g., 1979) and Lawson's dishwasher analogy (1981). One study (Bernard et al. 1981) provided either illustrations or prose as advance organizers to aid understanding of technical information concerning complex brain functions. The study found that both procedures improved delayed recall compared to groups given no advance organizer, but that the illustration group was not superior to the prose group. Royer and Cable (1976) found similar results using a passage explaining electrical conductivity. They showed that the use of an abstract and illustrations improved recall compared to a group given abstract only. However, the abstract with illustrations condition did not result in improved recall compared to groups given only a concrete passage or an abstract with analogies. Thus, at the present time, there is no evidence that diagrams are more useful than prose equivalents as advance organizers.

Use of graphs and tables to present quantitative trends

There was considerable research activity in the 50s and early 60s on the best types of graphs to use to present quantitative information. From that time until the present, there has been very little activity. Macdonald-Ross (1978) does attempt to provide guidelines on graphs, including the conditions under which they might be preferred to tables.

STYLE

General considerations

The term "style" is a catch-all name to cover a large number of characteristics of writing that contribute to the quality and comprehensibility of writing. First year English courses attempt to teach the rudiments of style (grammar; use of simple, complex, and compound sentences; use of active and passive voice; organization; train of thought; perspective; consistency; etc.). Indeed, a good book on writing technique is essential for the technical writer. It is often assumed that, beyond the basic issues covered in a first year English course, style is a very subjective aspect of writing. Stratton (1979) questions this assumption. He has taken an empirical approach to attempt to characterize excellent versus bad writing, and he describes some of the elements that characterize excellent writing. Diehl and Mikulecky (1981) provide a check list for technical writers that emphasizes the importance of decisions about style-related and other issues in technical writing. The article by Chapanis (1965) brought technical writing into the realm of human factors psychology. This article provides a number of examples to illustrate how differences in "style" of short technical descriptions can influence the effectiveness of use of a piece of equipment. DeBeaugrande (1978) gives a few examples of good and bad technical writing at the sentence level. Ramsey (1977) approaches the problem of style from the perspective of transformational-generative grammar.

Readability

One aspect of style that has received considerable interest is readability. A readability measure attempts to objectively specify the difficulty level of text based on the style of writing. The goal is to prevent a mismatch between the reading level required by the text and the reading ability of the target audience. The basic idea is that long sentences and sentences with long words are more difficult to read. A formula combining these two variables predicts the comprehension level attained by normative groups at different grades in school. Some formulas add other variables (e.g., average number of syllables per word, number of words with three or more syllables per word, a comparison of words to a known dictionary of easy and difficult words, etc.). Six of the most common readability formulas are described by Barry, (1979). These six formulas have been implemented in FORTRAN for use on computers.

The use of readability formulas is controversial (e.g., Chapanis, 1965; Kintsch and Vipond, 1979; see also Powell et al., 1981). It is generally accepted that the objective, quantitative measures of readability provided by most formulas are necessary but not sufficient for producing readable material. That is, just because the words are short and common, and the sentences uncomplicated, does not mean that the resulting text will be meaningful. Some formulas attempt to get at other aspects of writing style. For example, Colby (1981) describes a readability index that takes into account the ratio of abstract to concrete words.

With the increase in computer controlled word processing equipment for generating manuals, it is now feasible to use one or more of the hundreds of readability formulas on the whole manual. Computer controlled readability programs can also list long words, and indicate the location of unacceptably long sentences. Some formulas require a human judgment about words. For example, one index (Vervalin, 1980) does not count proper nouns that are long, and counts single words that are combinations of simple words (e.g., motorcycle) as two words. These requirements plus counting syllables makes the use of computers, for some readability formulas, difficult. However, another word processing development, the use of spelling and other special dictionaries (e.g., of three syllable words), combined with a readability program can overcome these problems. The introduction of word processing has caused a rebirth in the use of readability formulas that will probably influence technical writing for a number of years.

The United States military have specified requirements for readability for all manuals (Kniffin, 1979). The specifications call for reading grade level to be determined by the contracting agency with readability samples taken by the manual producer using sampling techniques and procedures described in the specification. Since a large number of manuals are produced for the United States Armed Services, many organizations that would not ordinarily use readability formulas will be exposed to them.

PHYSICAL CHARACTERISTICS OF DOCUMENTS

TYPOGRAPHY

A great deal of research has been performed on typography -- typeface style, size, and weight (how dark the letters are); use of upper and lower case letters; letter, word, sentence and paragraph spacing; contrast; type of paper; ink density (blackness and glossiness); whether to right justify text or not, etc. Tinker (1963) has written a classic text on the topic, and Spencer (1968) has a text with guidelines and illustrations of the use of the guidelines. A bibliography of references prior to 1974 addressing most issues is available (Hartley, Fraser & Burnhill, 1974). A good review which also considers methodological problems is provided by Reynolds (1979). This article also extends the issue of typographic legibility to other media including CRTs, optical character readers (OCR), microfiche and computer printouts. This is a good source of information for researchers and technical writers. It is worth noting that, while many feel the issues concerning typography are pretty well settled by early research, MacDonald-Ross (1978) criticizes much of the research that went into commonly accepted recommendations. In particular, he is concerned with generalizing experimental results, obtained when all variables are held constant except one which is manipulated, to real situations which are more complex. He is also concerned about the applicability of results obtained in optimal reading conditions in a laboratory to the sub-optimal conditions normally encountered by readers.

Although this issue will be debated for some time, it seems that, in general, the typography guidelines have served the publishing industry quite well. Reynolds, Spencer, and Glaze (1978) address the issue of legibility and layout of material on a CRT device. The problems addressed in this article, as well as problems with interactive dialogue discussed by Peterson (1978), will be of increasing importance as on-line documentation becomes available.

LAYOUT

Bissell (1977) emphasizes the importance of physical layout (e.g. organization of text and pictures, margins, indenting, paper size, etc.). He takes the anti-guideline view that the technical writer must attend to this problem and should use his imagination. Judisch, Rupp and Dassinger (1980) evaluated the adequacy of microfiche service manuals and found them unsatisfactory. They did find that an integrated text and graphic layout was preferred by repairmen over a traditional layout and resulted in speedier service. Unfortunately, it is not clear from their article what is meant by graphic integrated manuals. A study by Burnhill, Hartley and Young (1976) also discusses some of the problems with layouts. When many large figures and tables disrupt the text, the authors recommend that figures or tables extend across the full page and that the text be organized in a single page-wide column. In addition to these articles, the books on typography by Hartley (1978), Tinker (1963) and Spencer (1969) include material on layout. Grimm (1981), Martin (1981) and Pakin (1981)

have summaries of document preparation techniques that include layout information.

Tables in textual material

Wright and Fox (1970) describe research on comprehension of tables and provide general guidelines on spacing, print size, rounding, horizontal versus vertical organization, etc. in the construction of tables. Macdonald-Ross (1978) and Hartley (1981) summarize these recommendations and add others. These simple, straight forward rules should be consulted by anyone when preparing tables.

Burnhill et al. (1976) discuss the issue of the layout of tables on single and two column text when the table disrupts the reading of the text. For example, a situation with two columns of text per page and a table which extends across the entire page leads to a great deal of confusion about where to continue reading after the tables. They found that a single page-wide column and a page-wide table resulted in the least confusion.

Typographic cues

Typographic cueing is the use of variations in printed text (underlining, bold face, colors, different type styles and sizes, indenting, etc.) to provide a visual distinction among different levels of text content. The idea is to provide in the text itself, the type of emphasis which readers often provide on their own (underlining, highlighting or marking important material with an asterisk or vertical line). Experimental results have been inconsistent, even contradictory. For example, simple cueing often helps learning/retention of the cued material, usually at the expense of noncued material (e.g., Foster and Coles, 1977, Frase and Schwartz, 1979; and Hersberger and Terry, 1965). However, this effect can depend on the type of cueing (Foster and Coles, 1977). In addition, some studies found that cueing helped only when subjects knew what questions would be asked (e.g., by a pre-test or by instructions about the type of material to be tested) while other studies found improvements when cues were provided by themselves (e.g., Glynn and DiVesta, 1979).

One study (Fowler and Barker, 1974) compared active cueing (where subjects underlined important material themselves) with passive reading of material which had been underlined by others. They found that active cueing resulted in better recall than passive reading of others' underlinings, probably because the process of underlining insured that the materials had been read.

At this time, it is not clear if typographical cueing is advantageous or not. Foster (1979) reviews the research on cueing and concludes that many studies underestimate the effectiveness of typographical cues because of poor methodology. It is clear that the technique has not been widely adopted in educational books and journals. Waller (1979), in a general discussion of selective reading strategies of which typographic cueing is a

part, notes that technical material in particular is read selectively. If so, typographic cueing should be effective. It seems likely that writers may be unwilling to use typographical cueing because of a reluctance to admit that a large part of what they say is not as important as the remainder of the text.

MANAGEMENT ISSUES

MANAGING THE PRODUCTION OF DOCUMENTATION

Advice on management of the documentation effort can be found in the literature. It should be noted, however, that a great deal of the discussion of management of document preparation has to do with the production of software documentation or technical specifications intended for the use of engineers or programmers. Little has been written about management of document preparation for the end user, and no general reviews of that literature were found. However, there are some good general discussions applicable to production of documents for end users. Wright (1981a, 1981b) does an excellent job of portraying the needs of the end user and describing the variety of skills required to produce a user manual. Snyders (1981) has a very practical discussion of the production process. It is particularly valuable for a company which is considering the use of a professional manual development company to write and produce the manual. These three articles take an organizational view of the documentation process and will be of interest to managers.

For larger companies who maintain in-house technical writers, three articles have dealt with the relationship of the writers to the project. Rosenwinkel (1981) and Goff (1979) have advice on how to best integrate this staff into the product development effort. Rosenwinkel notes that documentation tends to be given low priority for a variety of reasons, not the least of which is a belief by product designers that their system will be so well designed and easy to use that no manual is required. Under these conditions, good management is required to insure that the technical writers are both used and appreciated. Goff discusses the responsibilities which should be given to the technical writing staff, and gives some suggestions for hiring and developing a technical writing group. Kantner (1980) suggests that the lead writer should be made the project manager. This is a twist on a common practice of making the project manager in charge of technical writing.

Another topic associated with production of documents has to do with methods of quality control for manuals. There are basically four suggestions concerning how this should be accomplished: use of guidelines, use of standards, use of skilled personnel and user testing. The first three topics are discussed below and the last topic is covered in the methodology section under "evaluation of manuals".

Use of guidelines

One approach to producing good documentation involves providing a set

of guidelines to the writer. Several such lists have been developed. Skepticism about the use of such methods has been well stated by Wright (1981b). She feels that short lists are too vague, while long lists tend to be hard to remember. Further, judgment is required for a writer to realize that he is violating a guideline. And if he is aware of violating one, he has to judge the extent to which it is a serious violation. Wright argues that emphasis should be turned from the development of guidelines to that of developing highly skilled technical writers.

Standardization

Methods of standardizing documentation have received considerable discussion. Grimm (1981) indicates areas in which standardization would be useful, and Brusaw (1980) discusses a method of standardizing vocabulary, by making writers utilize only words provided in a directory. Silbey (1979) describes procedures for developing standards. While standardization provides a method of insuring that certain conventions will be followed and that a certain organization will be used, standardization cannot stop a writer from writing ambiguous, overly complicated or misleading sentences (Brusaw, 1980).

Skills required of technical writers

A number of writers suggest that the best insurance for a well written document is a skilled technical writer. Wright (1981a, 1981b) has discussed the skills needed by technical writers, or alternatively, the skills which need to be represented on a documentation team. There should be experts in task analysis, clear use of language, use of graphics and typographic principles, interpretation of guideline research, and management of production. All of these skills are required in the production of a document.

A number of writers discuss the need for both writing skills and experience with the technology. Unfortunately, both skills are difficult to find in the same person, so that in-house training is typically required. There is some interest in training English majors in the skills required for technical writing in some universities (Brockmann, 1981). However, at the present time, the training is often a single course using one of the guide books such as Hartley (1978) as a text.

The alternative is to find a member of the technical staff who is willing to write or a writer who is interested in learning about technology, and provide in-house training. Brantley (1981) discusses typical approaches to this problem and Petersen (1981) presents the views of individuals involved in technical writing concerning qualifications and training.

METHODOLOGY

TYPES OF METHODOLOGY

There are basically two different motivations for discussing methodology in the documentation literature. One discussion concerns the types of research strategies which will lead to useful guidelines. The second discussion centres around the type of methods to be used to evaluate documentation which has been written. Finally, there are a few writers who emphasize utilization of methodology at the planning stage, particularly task analysis (Chapanis, 1965; Macdonald-Ross, 1978; and Wright, 1981a). Typically, these approaches are seen as complimentary.

Approaches to developing guidelines

Most of the review articles mentioned previously in this report discussed the lack of effective research and attempted to point to the research strategies which led to the lack of useful results. Most of the papers pointed to laboratory research investigating a single variable, using simplified stimulus material and simplified performance criteria as a major problem. "Is it appropriate to do single-variable tests on simplified stimulus material? How does such stimulus material relate to the real design problems of the typographer? The trouble is that most of the variables do interact strongly" (Macdonald-Ross, 1978, p. 77). Many writers also indicate that "whether" questions (e.g., Do advance organizers lead to better learning? Do illustrations improve textbooks?) tend to be too broad and result in little that is useful. On the other hand "when" questions (e.g., Under what conditions will advance organizers improve performance?) are particularly suited for the development of guidelines. Thus, there is agreement that research which takes into account interactions among variables is needed.

There is also agreement that the variables to be studied should be carefully selected to insure that they are relevant to practical considerations. How can they be identified? Chapanis (1965) suggests the use of the critical incident technique, that is case studies of particularly poor and good documents, to determine which factors are important. Stratton (1979) suggests that excellent and mediocre writing should be compared to determine major sources of differences in style. Macdonald-Ross (1978) and Anderson (1980) suggest that research should focus on the intuitions of skilled writers and graphic artists. McConkie (1978) argues that empirical, descriptive studies of how people naturally process information should be the starting point for research. Brody (1981) wants to start by examining the general relationships among various features of instructional text. Mayer (1981) works on practical problems such as teaching computer programming, but uses an information processing model to determine which variables to manipulate.

The common theme running through these suggestions is that the research needs to be anchored to variables and tasks which have real-world validity. Research may focus primarily upon the documents, or upon the task, or upon

user characteristics. However, determining this focus is seen as a starting point, not an end in itself. The research also needs a framework or systems approach which considers the characteristics of user, task, performance measures and other situational factors which will all interact with characteristics of the manual. At present, the method of selecting variables for study appears to be a matter of personal preference. In fact, most of the methods suggested above have been successfully used. The important point for researchers interested in producing results that are potentially useful is that there should be some type of preliminary work to provide a sound rationale for the variables being studied.

Along with the concern for studying variables based upon a carefully considered rationale, another concern is that the experiments are properly designed and executed. Some of the research in the area, particularly that which is attempted by practitioners who have had little training in experimental design, fails to meet these criteria. Thus, there is the typical gap between the researcher and practitioner, where the researchers fail to address problems which practitioners see as pressing, and the methodology of practitioners is inadequate to provide good guideline research. However, there is a note of optimism, in recent reviews, that this gap can be bridged. On one hand, there is an increasing desire on the part of researchers to work on problems having practical application. In addition, the new cognitive theories are focusing on more molar problems than in the past: "Research on the cognitive processes involved in learning from text will quickly make contact with work on reading and on instruction and should contribute to these areas" (McConkie, 1978, p. 39). Finally, the large number of review articles attempting to look for principles which are useful to practitioners, indicate that there are a growing number of researchers interested in assuming the role of professional communicator or interpreter as suggested by Macdonald-Ross (1978).

In addition to changes in the type of research performed by researchers, there are changes in the approach of practitioners. There are articles which are written specifically to argue for better research by practitioners and better use of available research by technical writers. Two of the better articles are those of Wright (1978) who is a researcher and Anderson (1980) who is a professor of English. Hopefully, reducing the gap between practitioners and researchers will result in more useful guideline research.

Evaluation of documentation

After documentation has been written, it needs to be tested to determine if it is usable by the group for whom it is intended. The methodologies needed for this type of work are considerably different from those needed for guideline research. Instead of placing priority upon carefully controlled experimentation to determine causal variables and their interaction, the empirical work should be designed to find out whether or not users are able to use the documentation as intended. If the user cannot use it as intended, then problems must be identified and

revisions made.

It should be noted that empirical tests on user groups are not common practice at the present time. Much of the emphasis is placed upon quality control through thorough review of documents by various professionals (see Wagner, 1980), and upon the use of checklists by the documentation provider (Martin, 1981 and Wagner, 1980) or by the purchaser (Pakin, 1981). Lack of research is partly due to a confusion between the type of research required to provide guidelines, and the type needed to test a document. Wagner's negative opinion of manual testing stems from experience with an inappropriate form of research: "The typical test is very specific and geared to a very small part of a manual . . . It is not cost-effective to test more than a small percent of the manual . . . Statistically significant test scores require too many test subjects" (p. 99).

In contrast, there is a new emphasis upon looking at usability of manuals by having a small group of potential end users involved in the testing. There are several suggestions concerning how to proceed. Winbush and McDowell (1980) describe a systematic approach by the test coordinator, an individual charged with assessing the usability of manuals. This highly structured approach involves three parts: 1) manual reading in which subjects first identify sections they find difficult followed by a written test on the document content; 2) procedural testing in which subjects attempt to actually perform tasks described in the manual in a simulated environment; 3) attitude questionnaire administration to determine the degree to which users find the manual to be satisfactory. Companies large enough to hire a human factors person responsible for procedures such as dialogue testing, documentation testing and development of training procedures, should see that the description of these procedures is read by the person in charge of testing.

However, less quantitative and structured methods, which take less time and may be equally effective, are available for testing. Atlas (1981) and Lewis and Mack (1982) have utilized similar methods with excellent success. Testing takes place with a very small number of users. Often modifications are suggested after testing only one or two users. Atlas (1981) refers to the procedure as a user edit. "The user edit is based on a very simple idea: Find someone who knows nothing about your machine and have him work with it, using only your manual as a guide; his errors and hesitations should tell you where the weak points are. To get more detailed information, it is also a good idea to ask users to talk while they work, telling what they are trying to do, what they are looking for, what gives them trouble, and what they suggest to make the manual better" (p. 28). This approach may be particularly suited to companies that do not make a sufficient number of user products to hire a human factors expert. It is possible that any perceptive observer can use the techniques described by Atlas, since no quantitative analysis is required. At present, the reliability of such techniques has not been explored.

Two methodological notes should be kept in mind in user testing. First, Marcel and Barnard (1977) report that there were major differences

between the reading patterns of subjects asked to explain what instructions meant without using the machine and the reading patterns of those who actually tried to use the machine. The first group systematically read through the instructions. The second group however, did not use the instructions in order, but tended to jump around, trying things on the machine without referring to the instructions. Lewis and Mack (1982) noted a similar problem with secretaries using a tutorial for a word processor. They tended to jump around in the manual, even though it had a carefully planned order. Thus, to get an accurate impression of how a manual will be used, testing should involve actual interaction with the machine, or at least with a drawing of the machine.

Second, Dillon and Tombaugh (1982) noted that user testing in a laboratory environment was excellent for insuring that users could follow the instructions. However, a test in the actual environment where the device was to be used showed that the intended users (who had expressed satisfaction in the laboratory) did not like the tone or depth of material presented in the field. Thus, it may be that user tests to determine if the instructions are clear and those which measure user satisfaction will require different techniques.

In summary, techniques are being developed to insure that manuals are usable by the group for whom they are intended. These techniques can be employed with minimum time and effort and are suitable for use, not only by the producer of the document, but also by the potential buyer to determine if the product can be used by the intended staff.



CURRENT PRACTICES

ANALYSIS OF EXISTING DOCUMENTATION

WORD PROCESSOR DOCUMENTATION

We analyzed existing documents for a number of word processing systems, including those available for single-purpose word processing systems such as IBM, AES, WANG, and MICOM; those available for personal computers, such as STYLO and WORDSTAR; and one text processor on a large mainframe computer.

Basically, there were three methods of presenting instructions to the user: reference manual, tutorial and user guide. The mainframe manufacturer provided only a reference manual. Some of the manufacturers have designed tutorials with which the user is expected to work at his own pace and learn on his own. It is assumed that the learner is reading in front of a word processor and following the instructions. Other manufacturers provide an introductory section in which simple operations are explained with the use of examples before a section which gives the more advanced commands. While some documents combined introductory and reference manuals, the mainframe computer document was the only strictly reference document.

TUTORIALS

Tutorials are used in both high and low budget documents. The major difference in cost can be related to layout considerations. High cost documents tend to place very little material on a given page; clearly distinguishing between the command the user should give and the system response by the use of cueing. Cueing varied and included such things as the use of different colored type and illustrations of screen printout. There tends to be a much greater use of diagrams in the higher cost productions as well. Low cost documents tended to carry ideas across pages, and used simple underlining to distinguish between input and output.

The tutorials tended to assume that: 1) the reader will follow instructions perfectly; 2) the reader does not need to review or compare. This was most apparent in manuals that tried to present a single idea on a page.

INTERVIEWS

We interviewed both users and producers of documents. Open-ended questionnaires were designed as a guide to the interviewer, but the interviewer was encouraged to follow other topics as raised and a number of issues not on the questionnaire were covered. The questions that formed the basic questionnaires appear in the next section Interview Schedules, pages 25 to 28.

USERS

We talked to three word processing instructors in different business schools, two secretaries who use word processors and one school administrator highly involved with helping teachers integrate computers into their classrooms. The instructors had experience with two or three of the tutorial systems. They made similar comments about these documents. The manuals cannot be used by students without help. There are several reasons for this. First, students do not read them carefully, often skipping over things. Second, there is no effort to give students an idea of how to recover if they make a mistake, so students get "stuck" at the first error. Third, there is no effort to integrate the material. There is no review and when more than one way exists to do the same thing, no effort is made to tell students when to use each one. To overcome these difficulties, all of the schools have written their own manuals to accompany the supplied manuals.

The major characteristics of manuals that instructors found helpful were use of diagrams and a clear presentation of how the screen should look following each operation. Chief complaints were that there are actual errors in manuals (as if the person who wrote them never tried to use them) and that indexes tend to be very poor, incomplete or non-existent.

Even the experienced instructors found that they had to call the vendors for help on occasion because of unexpected difficulties. At the manufacturers' request, they also reported errors in the documents and made suggestions for the index; however, these corrections were rarely made in later versions.

The school administrator, who is involved with use of application programs on personal computers such as Apples, Pets and TRS-80s, felt that the provided manuals are completely useless to teachers. The teachers learn how to operate the machines through workshops, either organized or informal, and find it necessary to provide their own instructions to students. The manuals involved are (1) general operating manuals, some of which are directly written for teachers, and (2) the documentation for application programs.

The two secretaries interviewed use two different word processing systems. Their comments were not as critical as those of the other users interviewed, perhaps because of their lack of a comparison and their generally positive attitudes toward word processing. They both felt that their manuals would be useless if they hadn't had a course with an instructor. They both complained of difficulty in finding topics in the index, and of topics not covered or erroneously covered in the manuals. However, they are basically satisfied with their manuals, and they both pointed out that they have a number to call if they cannot find an answer to any question.

DOCUMENTATION WRITERS

We interviewed two technical writers involved with companies large enough to hire writers and representatives of three companies who do not hire special technical writers, but have the writing done by the technical or sales staff. Typically, the only training provided to a technical writer is an introduction to characteristics of the product, and even this is not always the case. One writer took a manual, written by a programmer, and made it nontechnical without ever using the word processing system it was written for. Manual writers rarely start from scratch in terms of organization; another document, written for a similar purpose, usually serves as a guide.

Most of the writers were aware that they were writing for end users, and that, as one writer put it, they needed to make their documents so "any idiot" could use them. However, only one company tests its manuals. It does so by asking a secretary whether it is clear. Some companies see the document serving the dual role of providing instruction and of being a marketing device. When this is the case, more expensive documents are produced using bold print, highlighting, color, etc. Curiously, one of the large companies that has a special documentation group does not use their services on a routine basis because, in terms of internal charges, the service is "too expensive."

There were differences in the attitudes of writers and administrators about the need for technical writing guidelines and user testing of documents. Those who have had more opportunity to work with end users are more likely to feel a need for guidelines and a need for testing. Some were able to discuss mistakes made in the past (one company tried to develop a set of icons to make their instructions easier to read, but found that users thought the instructions were in Japanese and made no effort to use them). At other times, the opinion was expressed that the system was so easy to use that no instructions were needed. (Telidon was used as an example of this type of system). Finally, there is a tendency to assume that a highly sophisticated production system for documentation guarantees good documentation. The emphasis is on typography, layout and graphic capability, rather than on content.

In summary, it is clear that there is a need to raise technical writers' level of awareness of documentation issues. The existence of professional journals and organizations for technical writers are signs that such an awareness is being developed. Editors of the technical writing journals are highly concerned with guidelines and the testing of manuals. However, it will take time for this young discipline to reach all those involved in technical writing. None of the writers interviewed read the technical writing journals or were members of technical writing professional organizations.



INTERVIEW SCHEDULES

INTERVIEW SCHEDULE FOR TECHNICAL WRITERS

1. When is document written?
 - During product development?
 - At completion of product development?
2. Who writes the documentation?
 - Technical writing team
 - Technical writer individual
 - Technical personnel
3. Is there means of integration of writers with product developers?
4. What is seen as the purpose of the documentation?
 - Instructional
 - Problem solver
 - Sales pitch
 - Encyclopaedic reference
5. What is the perceived importance of the documentation in the overall product?
6. End user considerations:
 - Is the end user known to the writers?
 - Is the document written with the end user in mind?
 - Style conversational and non-technical or technical?
7. Type of document produced:
 - On-line
 - Paper
 - Reproduction methods
 - Diagrammatic support
 - Typography
8. Do you follow guidelines concerning:
 - Reproduction
 - Diagrammatic support
 - Typography
 - Form
 - Language
 - Structure
 - Indexing
 - Style: modules
 - treatise
 - specification manual
 - conversational

9. Do you use field trials or pretesting of documentation?

Testing by:

Users?

Technical staff?

Other?

10. Are there channels for feedback?

Interviews

Follow-up forms

Complaint department

11. Do you have questions that you would like to have answered about guidelines in documentation writing?

INTERVIEW SCHEDULE FOR TRAINERS OR INSTRUCTORS OF END USERS

1. What type of documents do you use?
 - Reference
 - Instructional
 - On-line
 - Paper
2. What aspects of documentation do you find
 - satisfactory?
 - unsatisfactory?
 - need improvement?
3. Do you refer to the documentation during the training sessions?
4. Do you encourage (and train) students to use the documentation?
5. Are the documents available to the students during training?
6. What is the students' reaction to the documentation?
7. Is the documentation:
 - Clear?
 - Instructional?
 - Understandable?
 - Organized for easy reference?
 - Accurate?
 - Missing pertinent information?
 - Full of superfluous information?

INTERVIEW SCHEDULE FOR PERSONNEL WORKERS
WHAT THEY LOOK FOR IN A TECHNICAL WRITER

1. What is the situation of the technical writer?
 - In-house, exclusively a writer
 - In-house, with job responsibilities other than writing
 - Outside the company technical writers
2. What qualifications does a person need to be hired as a technical writer?
 - Technical knowledge
 - Writing experience/skill
 - Knowledge of reproduction methods
 - Educator/teaching skills
 - Other
3. Is there In-house training for your technical writers?
 - What areas?
 - What methods?
 - course
 - on job training
 - apprenticeship
4. Job parameters
 - TIME
 - Exclusively technical writer
 - Time share writing with other duties
 - Individual effort as writer
 - Team of individuals share writing
 - EXTENT
 - Create all documentation from inception to final product
 - Review and revise documentation
 - Advisors only
 - Assist only
5. Integration with product developers:
 - To what extent is there an association between the writer and technical people?

RECOMMENDATIONS

GOVERNMENT INITIATIVES

There are several possible ways that the Department of Communications can assist Canadian firms producing office automation systems and components with their documentation development. First, the federal government can assist by supporting research and/or providing information about guidelines. Second, standards for different types of manuals can be established and made available. Third, government can sponsor the development of training programs for technical writers and others concerned with documentation. Fourth, procedures for user testing can be developed, and reasonable usability standards for documentation can be made available for Department of Supply and Services to write into government purchase agreements when documentation is an important adjunct to a piece of equipment or a system. Advantages, disadvantages and possible mechanisms are discussed for each of these alternatives.

PROVIDING GUIDELINE INFORMATION

There is a tendency to uncritically accept the notion of lists of guidelines as an appropriate vehicle for conveying information about research findings to technical writers. Wright (1981b), among others, questions the effectiveness of this approach because many of the guidelines require interpretation by the writer. For example, a guideline such as "avoid jargon" requires that the writer is able to recognize those terms which would be unfamiliar to his audience, a major difficulty for an engineer or computer scientist. With respect to this criticism, it is possible to separate guidelines into two types: those which do require judgment because they relate to content or layout, and those which can be mechanically implemented, such as those concerned with format and typography. Wright's reservations only apply to the first type.

A second consideration is the effectiveness of a list of guidelines, even if they are unambiguous. First, if the list is long, it is likely to be ineffective because of limitations of users' memory, and because statements of priorities and trade-offs to resolve contradictions among guidelines are rarely included. Second, guidelines tend to assume that all documents will be produced with an unlimited budget. This assumption combined with the undefined or unknown priorities for making choices among guideline items, often results in a list of guidelines that lacks credibility and is not used.

A third reservation about guidelines concerns the degree to which they are correct. Guidelines tend to be a mixture of rules based on intuition and research, with the quality of both varying considerably. A set of well-packaged, but poorly conceived guidelines can have the disadvantage of perpetuating sub-optimal practices and discouraging research.

Another consideration in development of guidelines is the speed with which they can be expected to become obsolete. This is a direct function of the amount of research activity in an area. For example, there seems to

be little activity in the area of typography, while research is intense on the cognitive processes directly relevant to the content of documentation. Thus, guidelines for typography are less likely to become obsolete in the near future, while an effort to write content guidelines at the present time might actually slow the penetration of new research findings into practice.

For the foregoing reasons it is our recommendation that a list of guidelines should not be developed at this time. An alternative which we feel would be more appropriate is to develop examples of documentation to distribute to interested manufacturers. A range of document examples should be developed to show acceptable typography and layout for low budget, as well as higher budget documents. Examples should also be selected to illustrate content related developments in the research literature, with the circumstances under which the techniques are useful clearly noted. To insure the integrity of the examples, they should be tested for usability and satisfaction, and their content should be reviewed periodically by individuals acquainted with the research literature to determine if new developments have made them obsolete. Essentially, the idea is to bridge the gap between research and practice by using an interpreter of research to provide examples, rather than lists.

There are two reasons for suggesting this approach. First, it is clear that most technical writers use a model document to guide their own writing. Thus, a document that is known to be well-designed should be a more appropriate model than one which is simply convenient. Second, the availability of such documents can form the basis for workshops to be given to technical writers (see recommendation number 4).

USABILITY -- TESTING WITH USERS

No matter how well developed the guidelines, standards or examples for documentation are, user testing is necessary to insure that the document is well designed. A systematic effort should be made to construct cost effective, reliable testing procedures that determine the usability of documents. Manufacturers should then be informed of these efforts through pamphlets, workshops, and by specifying usability requirements in government purchase agreements. We highly recommend support for usability testing research and training.

GOVERNMENT SPECIFICATIONS FOR USER DOCUMENTS

In an effort to insure that documents are at an appropriate level, the Department of National Defence requires a preliminary six-month period of document use then incorporates suggestions from this period into the final document for specially designed systems. This is a form of usability testing without provision of formal performance criteria. Without a definition of usability in terms of specific performance criteria such as the percentage of users who are able to answer certain questions from the manual, or the time required to learn the material, etc., such requirements will be of limited value. The United States armed forces approaches the

usability requirement by specifying readability requirements for all its documentation. This prevents the acceptance of manuals full of large words and long sentences, but does not directly guarantee that the document can be used in the way it is intended. A more direct approach would be to specify the degree to which the manual is expected to fulfill usability requirements. For example, the requirement for a training manual might be that eight of a sample of 10 potential users who learned from the manual should be able to perform 75 percent of the tasks specified in the objectives. The major danger of such an approach is that unrealistic criteria might be set. The level of criteria might be too stringent under the constraints of time and budget. There is also a danger that such standards might be included for products where the manual is basically not a major part of the system. We recommend inclusion of user testing of documentation on a few contracts (possibly in government sponsored field trials) to determine the feasibility of this approach.

EDUCATION OF TECHNICAL WRITERS

There is a growing awareness that there are some distinct skills required in the production of manuals, particularly when they deal with flexible systems intended for use by novices. The proliferation of high technology systems has resulted in an equivalent increase in the need for good documentation. To support the high technology revolution, the need for training programs and courses for technical writers in skills such as task analysis, typography and layout, writing skills, and user testing are important. Government sponsored workshops on these topics should be offered immediately. These workshops might provide an appropriate seed for the development of programs in colleges, universities and industry. In addition, workshops are appropriate because in the near term most small companies will not hire technical writing specialists. The main thrust of educational efforts should be remedial in nature and directed toward those already responsible for document preparation. The emphasis should be on practical, low cost techniques which can be readily applied to existing projects. We recommend that the Department of Communications sponsor the development of training programs for technical writers.

RESEARCH FUNDING

While a large amount of the research in the past has failed to produce results which are useful to the documentation writer, the reasons for this failure are becoming increasingly clear. Single variable manipulations, the use of stimulus materials having no validity for generalization to real world problems, and use of poor research design in field research are all to be avoided. Trends in cognitive psychology toward working with more molar problems, trends in education toward more rigorous research methodology, and trends by reviewers to emphasize the importance of "when" as opposed to "whether" questions are encouraging. We recommend that government funding of research should encourage these trends by giving priority to strategic grants meeting these criteria, and by writing requests for proposals for contract research that will discourage the pitfalls mentioned above.

A first priority should be the development of the example documents and, concurrently, inexpensive but reliable methods of usability testing.

SUMMARY OF RECOMMENDATIONS

1. DEVELOPMENT OF GUIDELINES. Lists of guidelines should not be developed at this time. Instead, examples of well-designed documents should be distributed, along with explanatory notes .
2. DEVELOPMENT OF USER-TESTING METHODS. The examples above should be developed through the use of empirical user testing such as the user edit, which is inexpensive and easy to conduct. Information about the cost, reliability and effectiveness of these methods should be made available.
3. DEVELOPMENT OF USABILITY REQUIREMENTS. Research into the feasibility of including usability requirements as part of the contract specifications for manuals should be investigated.
4. EDUCATION OF TECHNICAL WRITERS. Documentation examples and user testing methodology should be made available. Workshops appear to be an ideal method of upgrading skills of currently employed technical writers.
5. RESEARCH FUNDING. Particular emphasis should be placed on determining the reliability and effectiveness of the testing methods while developing examples of documents.

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ANNOTATED BIBLIOGRAPHY

HOW TO USE THE BIBLIOGRAPHY

The following bibliography should be helpful to those who want to learn more about the articles available on documentation-related issues. The bibliography is organized alphabetically by first author. A subject index is provided at the end of the bibliography. In addition to standard bibliographic information (title, authors, publication information), a brief description of each article is provided. The description includes points which, in our judgment, are noteworthy about the article. The number of pages (P) of the article and number of references (R) in each article are given at the end of each description at the right hand margin.

In addition to the description, we have included even more subjective comments which evaluate the usefulness of each article in the context of other available articles.

Each article has an entry number (seen at the top left margin) and is categorized by one or more appropriate key words (seen at the top right margin). The subject index includes the key words and refers to the articles by their entry numbers.

A letter code for each article is also included (below the key words) in an attempt to further categorize the type of content of each article. The letter codes indicate the types of articles as listed in Table 1.

TABLE 1. KEY TO LETTER CODES

<u>Letter Code</u>	<u>Description</u>
A	<u>Analysis</u> and synthesis of a topic
B	A substantial <u>bibliography</u> of articles on some topic
E	A report on <u>experiment(s)</u> performed to evaluate some aspect of document preparation
T	<u>Techniques</u> or methods useful to the document preparer
G	<u>Guidelines</u> useful for some aspect of document preparation
M	<u>Models</u> or theories about cognitive processes as they relate to document use
R	A <u>review</u> of the literature on some topic of relevance to document preparation

Entry Number 1

Key Words

design, editing
graphs, illustrations
G

Get In The Habit Of Editing Illustrations

AMSDEN, D.C.

Proceedings of the 27th International Technical
Communication Conference, 1980, 2, W-147-154.

Description

This article presents guidelines to help technical editors deal with illustrations in text. Pictures, graphs, diagrams and drawings should be subject to the same editorial control as the text of a document, and should be revised along with text in order to create an optimum combination of the two. General guidelines for editing illustrations are given. These include such things as considering the number and form of illustrations to be used, the level of detail, placement, and type of lettering. Specific guidelines for editing graphs, diagrams and drawings, and reductions are also given. These deal with methods for increasing the simplicity, conciseness, clarity and organization of illustrations within themselves and within the text.

8P, OR

Comments

These guidelines could be useful to production people, especially when used in combination with suggestions found in those articles which deal in depth with each particular type of illustration.

Entry Number 2

Key Words

persuasion
writing style
A

Research About Reading: Its Practical Uses In
Technical Writing

ANDERSON, P.V.

Proceedings of the 27th International Technical
Communication Conference, 1980, 2, R-247-251.

Description

Reading research has provided more than just readability formulas. It can show us how to prepare texts which can be read efficiently, and it can show us the importance of persuasion in technical communication. The author describes the approach taken by several authors who have set up guidelines for writing based on theoretical models of reading behaviour and experimental research in reading. The role of persuasion is discussed with regard to three activities of the reading process: attending to the text, extracting information, and relating this information to previous parts of the text or to previous knowledge. The writer must persuade his readers to attend to the text in the way he wants them to, he must motivate them to work at getting information from the text, and he must try to have the readers assimilate that information in the way he desires. It is important that a document be both well-written and written in such a way that readers are persuaded to use it most advantageously.

5P, 8R

Comments

This paper points to the need to use information gathered from reading research for writing readable, persuasive documents. There are no specific guidelines given, but references are provided to give the interested person a starting point for finding usable information.

Entry Number 3

Key Words

research
technical writing
A

The Need For Better Research In Technical Communication

ANDERSON, P.V.

Journal of Technical Writing and Communication, 1980,
10(4), 271-282.

Description

Although technical communication has become a sophisticated discipline with technical writers and editors now in great demand, it is falling behind in two important areas. It is pointed out in this paper that there are actually three distinct disciplines within technical communication: professional, teaching and theoretical. Professional communicators are progressing well, dealing effectively with problems as they arise in practice. However, both the teaching and theoretical disciplines are stagnating. Textbooks tend to be rigid in their approach to problem-solving, with new ideas neither presented nor encouraged. There are few attempts to empirically establish theoretical explanations of technical communication. The author suggests that research in these areas can be improved by posing important problems, generating alternative solutions, and by conducting and reporting research so that the best alternatives may be selected. Specific suggestions for carrying out these three things are given.

12P, 11R

Comments

This is an enlightening article which offers some practical suggestions for research.

Entry Number 4

Key Words

advance organizers
 instructional objectives, questions
 A, T

Study Strategies And Adjunct Aids

ANDERSON, T.H. in Spiro, R., Bruce, B.
 and Brewer, W. (Eds.)
 Theoretical Issues in Reading Comprehension.
 Hillsdale, N.J.: Lawrence Erlbaum Associates, 1980.

Description

Various strategies which students commonly use when studying are described, and their effectiveness discussed. Four learning aids (adjunct questions, advance organizers, text embellishments, and instructional objectives) are critically assessed, with the conclusion that the only effective study aid is the use of questions, since they require the learner to pause frequently and search for specific answers. The author describes a theory or model of studying based on questionnaire studies and observation of students. The model is used to differentiate poor and good study habits, and some suggestions are made for teaching students how to study more effectively.

20P, 39R

Comments

This article tends to focus on the activities of students in the learning situation, and not so much on the preparation of learning material. However, it reveals things about student behaviour which could be of help to those who write and design instructional text.

Entry Number 5

Key Words

learning, questions
M, RDoes Answering Higher-Level Questions While Reading
Facilitate Productive Learning?

ANDRE, T.

Review of Educational Research, 1979, 49(2), 280-318.

Description

Adjunct questions are seen as tools which can be manipulated by the instructional designer in order to produce desired learning outcomes. The paper looks at how questions at different levels of cognitive complexity affect learning. In the first section the research on levels of questions is reviewed. It is proposed that questions direct the reader to focus his attention on material which will answer the questions, and the more specific the question, the more selective the attending. Also, research indicates that questions about concepts and principles (higher level questions) as opposed to facts enhances problem-solving ability and transfer of knowledge to new situations. The second section presents a model of learning, and shows how question-level effects would fit into this model. Conditions under which higher-level questions will and will not facilitate performance are outlined.

39P, 105R

Comments

The level of complexity of adjunct questions appears to play an important part in determining the type of knowledge the reader will come away with. This paper presents an in-depth review of what research has determined so far on this topic. The learning model may not be of practical interest to instructional designers.

Entry Number 6

Key Words

evaluation
manuals, user needs
T

The User Edit: Making Manuals Easier To Use

ATLAS, M.A.

IEEE Transactions on Professional Communication, 1981,
PC-24(1), 28-29.

Description

A method of evaluating instruction manuals called "user edit" is described. It involves having people who know nothing about a particular machine learn to operate it by using the manual. Someone (preferably the manual writer) monitors and records the users' attempts to apply the information they read, looking for problems in content or style. It is suggested that this method be used in combination with other assessment techniques which can uncover problems missed by "user edit". These techniques are described.

2P, 1R

Comments

There are some very useful suggestions here on how to go about evaluating a manual to ensure completeness of content and usability.

Entry Number 7

Key Words

advance organizers

A

In Defense Of Advance Organizers: A Reply To The Critics

AUSUBEL, D.P.

Review of Educational Research, 1978, 48(2), 251-257.

Description

The author defends advance organizers against the critical reviews of Barnes & Clawson (1975) and Hartley & Davies (1976) as well as a number of others. There are two main criticisms: 1) that the concept of advance organizer is vague and that there is no operational definition of an advance organizer, and 2) that the methodology used in those studies which found positive effects for advance organizers was poor, and therefore the results are not meaningful. The author argues that he has operationally defined advance organizers in all of his early works, according to the original meaning of "operational definition". He also attempts to show that the methodological criticisms are not well founded.

7P, 20R

Comments

Ausubel does argue convincingly that some of the methodological criticisms are not well founded and that some of the advanced organizer research has been conducted under circumstances in which his theory would predict they would not be effective. Whether his operational definitions will actually lead to unambiguous classification is more difficult to determine without empirical tests.

Entry Number 8

Key Words

advance organizers
learning
A

The Facilitation Of Meaningful Learning In The
Classroom

AUSUBEL, D.P. in Hartley, J. (Ed.)
The Psychology of Written Communication. London: Kogan
Page Ltd., 1980.

Description

Distinctions are made between reception (passive) and discovery learning, and between rote and meaningful learning. Thus four combinations are possible: rote/reception, meaningful/reception, rote/discovery and meaningful/discovery. Meaningful/reception learning is seen as the most valuable in terms of efficiency of learning for these reasons: 1) rote material is arbitrary in nature, and is much more limited by memory processes than is meaningful material which is quickly integrated with existing knowledge; 2) discovery learning is more satisfying, but takes much longer to accomplish than reception learning. Several researchers have criticized the author's concept of advance organizers as being too vaguely defined. The author defends the usefulness of these adjunct aids when they are used according to his definition, which he says can be found in his early work.

10P, 18R

Comments

Those who are interested in using advance organizers in instructional materials should read this paper and Ausubel's early work where the concept is introduced. However, he does tend to define advance organizers in abstract terms even in early articles.

Entry Number 9

Key Words

advance organizers
E

The Use Of Advance Organizers In The Learning And
Retention Of Meaningful Verbal Material

AUSUBEL, D.P.
Journal of Educational Psychology, 1960, 51(5),
267-272.

Description

Two groups of 40 subjects read an unfamiliar 2,500 word passage on the metallurgical properties of steel, and were tested on this material. Prior to this, one group was given a 500-word introductory passage containing background material which dealt with general concepts of metallurgy but did not provide information which could be used to answer items on the posttest. This introductory passage was called an "advance organizer". The other group served as a control, receiving an historical introduction to the material. The results showed that the group given the advance organizer performed significantly better on a retention test given 3 days later.

6P, 2R

Comments

Even in this very early study on advance organizers, the concept is vaguely defined, and no actual examples are shown.

Entry Number 10

Key Words

advance organizers
adjunct aids
R

Do Advanced Organizers Facilitate Learning?
Recommendations for Further Research Based on an
Analysis of 32 Studies.

Barnes, B. R. & Clawson, E. W.
Review of Educational Research, 1975, 45, 637-659.

Description

These authors reviewed 32 studies of advance organizers, of which 12 reported that they facilitate learning. They saw no systematic patterns to account for the differences and concluded that no general effects can be found. They also conclude that the concept of advance organizers is not operationally defined and recommend a number of experimental tests to be made with operationally defined advance organizers (those which a panel of judges could distinguish from overviews).

23P, 34R

Comments

This review has been highly criticized by Ausubel, (1978), Luiten, Ames & Ackerson (1980) and Mayer (1979). A major difficulty with the article is its "voting approach" to deciding whether advance organizers are effective. Ausubel also argues that the term is operationally defined by defining the general distinction between the independent variables and other related variables.

Entry Number 11

Key Words

advance organizers
illustrations
E

Can Images Provide Contextual Support For Prose?

BERNARD, R.M., Petersen, C.H. and Ally, M.
Educational Communication and Technology Journal, 1981,
29(2), 101-108.

Description

Retentional images (pictures and illustrations used to increase the memorability of related text) have been found to be effective in several studies. In this study, a retentional image was given as a contextual organizer before a passage of prose. The effectiveness of the image was compared with that of a verbal contextual organizer (advance organizer). Both were found to be equally effective in increasing retention of passage content. Possible reasons for this are given.

9P, 25R

Comments

The results found here indicate that diagrams and prose can both be used effectively as "advance organizers" in technical manuals. This is one of the few studies in which diagrams and text are compared in this role.

Entry Number 12

Key Words

layout
A, GTechnical Manuals - A Visual Vacuum

BISSELL, D.E.

Technical Communication, 1977, 3rd quarter, 9-11.

Description

The attractiveness and even usefulness of technical manuals depend to a great extent on how much care has been taken in their layout. The author recommends that those who do layout should avoid the blind use of specifications and instead try to creatively respond to the demands of the particular communication and the needs of the intended users.

3P, 3R

Comments

While many writers are calling for more exacting specifications for various aspects of manual design, this article calls for more individual creativity, albeit within certain boundaries. There are a few layout hints included in the article.

Entry Number 13

Key Words

format, instructions
coding, short sentences
E

Formats For Presenting Procedural Instructions

BLAIWES, A.S.

Journal of Applied Psychology, 1974, 59(6), 683-686.

Description

Thirty college students used 3 different instructional formats (short sentences, logical tree, and "coding") to perform a set of problems. All three formats were equally effective for problems classified as easy. However, for difficult problems, short sentences and coding proved more effective, depending on the type of problem. Explanations for these findings are suggested, with particular emphasis placed on the concept of "coding".

4P, 5R

Comments

These results parallel those of Wright and Reid (1973). The coding idea is only briefly explained, but seems to have been a useful technique in this study.

Entry Number 14

Key Words

illustrations
ERelative Comprehensibility Of Pictorial Information
And Printed Words In Proceduralized Instructions

BOOHER, H.R.

Human Factors, 1975, 17(3), 266-277.

Description

Ninety naval personnel were tested for how quickly and accurately they could perform three tasks using different forms of procedural instructions. The tasks were: 1) locating and manipulating objects on an apparatus, 2) comparing information from tables in the instructions with information presented on the apparatus, and 3) matching symptoms shown by the apparatus with symptoms described in the instructions. The instructions differed as to the extent of pictorial and textual information. There were six combinations: 1) pictorial only, 2) print only, 3) pictorial + related print, 4) pictorial + redundant print, 5) print + related pictorial and 6) print + redundant pictorial. It was found that only the two combination formats which emphasized pictorial information (pictorial + related/redundant print) led to consistently fast and accurate results. Possible explanations for the superiority of this combination are offered in a detailed discussion.

12P, 15R

Comments

This paper offers some unique insights into why pictures and text must be carefully combined if they are to complement one another in the learning process.

Entry Number 15

Key Words

curriculum design
sequencing
G, M, R

Sequencing Of Instruction In Relation To Hierarchies
Of Competence

BRIGGS, L.J.

American Institutes for Research, Monograph #3, 1968.

Description

It is generally accepted that the order in which information is presented has a distinct effect on how well it is learned. This book looks at the research on sequencing, explaining the different theories and methods underlying the studies, and discussing the results and their implications. The experiments reviewed differ as to: 1) who controls the sequencing (learner or instructor), 2) length of the learning period, 3) extent of control (large or small units), and 4) degree of interaction of sequencing with other variables. This past research is used to develop a set of recommendations for future research. Also, some recommendations for curriculum design are given.

132P, 110R

Comments

This is an excellent review of the research literature on sequencing of instructional content. The practical suggestions which are offered in the conclusion are not many, since the lack of a systematic basis in the studies does not allow for definite conclusions. However, this is an excellent source of references in the area.

Entry Number 16

Key Words

artists, writers

T

Improving Communications Between Artists And Writers

BRILES, S.M. and Jacobshagen, H.P.

Technical Communication, 1979, 4th quarter, 12-14.

Description

In order for the work of the writer to complement the work of the artist, these professionals must work together closely from the inception of a project to its completion. There are many areas of potential difficulty in achieving this goal. Writers are word-oriented, whereas artists are visually-oriented, and this may create a communication problem. Also, writers and artists may not be encouraged to plan together. It is suggested that each group must learn what the other group needs to carry out their job. Artists need to know the purpose for which an illustration will be used, the subject of the illustration, the intended audience, the size requirements and the budget restrictions. Writers need to know the capabilities of the art department, the costs of producing various types of art, and the time artists need to complete different types of jobs. Suggestions for how the two groups can communicate these needs to one another are given.

3P, OR

Comments

Many articles talk about the need to integrate pictures and text. This paper deals with the practical problems involved among the professional staff in accomplishing this.

Entry Number 17

Key Words

design, legibility
readability, typography
A

Readability - How About The Typography?

BRINEGAR, J.P.

Proceedings of the 27th International Technical
Communication Conference, 1980, 1, G-29-31.

Description

The effect of typography on legibility has been extensively studied, but this article takes the unusual approach of looking at how typography affects readability. According to the author, legible words must be independently visible, whereas readable words must be read and understood quickly - they must flow together. Legibility is important in headings, signs, etc., and readability is important in continuous text. Typesetting documents can save money and improve readability.

3P, OR

Comments

This is a short, undetailed article which nonetheless is useful in pointing out ways to increase readability.

Entry Number 18

Key Words

language
reader characteristics, user needs
A

Language And Ergonomics

BROADBENT, D.E.

Applied Ergonomics, 1977, 8, 15-18.

Description

There is no one set of rules which defines how information can be best communicated to all kinds of people in all kinds of situations. Rules must be used judiciously, with the needs and characteristics of the reader always kept in mind. The passive voice and negative constructions are shown to be the preferred choices for various communication purposes. The importance of using language in a way which reaches a target audience in the desired manner is emphasized.

4P, 12R

Comments

This article stresses the idea that well-designed machines are useless without well-designed instructions accompanying them. Most of the comments are fairly general in nature.

Entry Number 19

Key Words

skills, technical writers
A, T

Teaching Computer Documentation In An Academic Setting

BROCKMANN, R.J.
Association for Computing Machinery, Special Interest
Group for Systems Documentation (ACM SIGDOC), 1981,
7(4), 29-33.

Description

Technical writing courses should encourage students to develop and practice skills which will enable them to communicate effectively with user groups. This article provides an annotated bibliography which includes sources of guidelines for user documentation. Five activities which should be included in technical writing instruction are outlined. These are: 1) team projects (to teach cooperation and the ability to communicate with other professionals), 2) egoless writing principles (to encourage objective criticism of one's own work), 3) procedural writing techniques (to teach how layout, language, graphics and organization interact), 4) on-line composition techniques (to learn how to format documents which exist within the computer instead of on paper), and 5) case studies (to provide practical experience in real-life documentation situations.)

5P, 15R

Comments

The references given in this article may be of use to technical writers.

Entry Number 20

Key Words

illustrations
RResearch On Pictures In Instructional Texts

BRODY, P.J.

Educational Communication and Technology Journal, 1981,
29(2), 93-100.

Description

Research has not provided designers with guidelines for how to best use illustrations in instructional text. The studies which have been done have differed greatly in purpose, methodology and conclusions. This paper brings together the results of research on the effects of pictorial illustrations on learning from instructional text, in an attempt to establish where problems lie and provide direction for future research. The author stresses the need to go beyond the superficial aspects of illustrations and to examine such factors as environment, person-as-learner, medium of presentation, and picture quality and quantity in relation to the effectiveness of illustrations.

8P, 40R

Comments

This presents a good examination of the current situation of research on illustrations. It provides useful guidelines for future research, but no practical suggestions for the technical writer.

Entry Number 21

Key Words

language
technical writing
T

Clear Technical Writing

BROGAN, J.A.
New York: McGraw-Hill, 1973.

Description

This book concentrates on words and how to use them effectively. The first three chapters show how to avoid using words in a redundant manner. The next four chapters deal with active vs passive and weak vs strong verbs, and how to develop verb forms which communicate most effectively. Four chapters are devoted to methods of changing complex words into simple words. The final five chapters describe various methods of grammar and punctuation for emphasizing and de-emphasizing material. There are short practice exercises given after every concept which is taught. Several other books on writing are referenced.

213P, 22R

Comments

The main advantage this book has over other books on the subject is the great number of short exercises which the reader can work through. The answers are conveniently placed beside each item, and the exercises are placed right after each section to provide immediate practice.

Entry Number 22

Key Words

instructional design
EEffects Of Review And Testlike Events Within The
Learning Of Prose Materials

BRUNING, R.H.

Journal of Educational Psychology, 1968, 59(1), 16-19.

Description

Sixty-nine subjects read a prose passage divided into six sections. After each section a review was given. The review was in the form of either declarative statements (statement condition) or the same statements with the key word left blank, to be filled in by the subject (test condition). Also, the material in the review was either on a criterion test (criterion relevant condition) or not on the test (criterion irrelevant condition). Thus there were 5 conditions: criterion relevant statements, criterion relevant test, criterion irrelevant statement, criterion irrelevant test, and control. It was found that subjects in both the criterion relevant statement and criterion irrelevant test conditions made significantly fewer errors on the criterion test than subjects in the criterion irrelevant statement group. However, the criterion relevant test group made the fewest errors of any group.

4P, 7R

Comments

The method of infrequent testing presented here is seen as an alternative to the high test/content ratio and rigid controls of programmed instruction.

Entry Number 23

Key Words

documentation, language
standards
T

Dismantling The Tower Of Babel In Computer
Documentation

BRUSAW, C.T.

Journal of Technical Writing and Communication, 1980,
10(2), 133-139.

Description

Writing computer documentation often involves understanding technically complex equipment. In such cases the technician is in the best position to write a manual, but he may not have the necessary writing skills. This is an account of how NCR solved this problem by selecting a vocabulary restricted to 1,350 words to be used exclusively in writing all their technical manuals. The essential features of the vocabulary are described, and its advantages for writers and readers are pointed out. The author recognizes the necessity of developing a similar system which controls sentence complexity.

7P, OR

Comments

This is an interesting method of standardizing document content and promoting readability of manuals. It seems to have worked well for the developers, and they encourage others to implement similar systems.

Entry Number 24

Key Words

editing, rhetoric
ASituational Editing: A Rhetorical Approach For The
Technical Editor

BUEHLER, M.F.

Technical Communication, 1980, 3rd quarter, 18-22.

Description

Technical editors must be proficient not only in grammar, spelling and punctuation (programmatic skills), but also in the use of rhetoric. Rhetoric is the use of language which takes into consideration who is writing the message, what the message is, the purpose of the message, and the audience for whom it is intended. It is argued that the unbending use of programmatic rules to remove all "excess" content from documents may in fact make the message less effective. The editor should consider each editorial situation individually, and decide for himself the best way to apply grammatical rules. Programmatic and rhetorical skills which editors should possess are outlined.

5P, 11R

Comments

This article serves to consolidate what seems to be a general feeling among those concerned with the communicative quality of technical documents, i.e. that rules must be tempered by the demands of the situation. Interestingly, the programmatic skills listed are concrete in nature, but the rhetorical skills are defined abstractly. This raises the question of whether such skills can be realistically called for, since they cannot be readily measured or taught. (See also Walters, 1980.)

Entry Number 25

Key Words

design, tables
guidelines
G

Table Design - When The Writer/Editor Communicates
Graphically

BUEHLER, M.F.

Proceedings of the 27th International Technical
Communication Conference, 1980, 1, G-69-73.

Description

Designing tables requires certain specialized knowledge which many writers and editors do not have. Tables must be both rational (they must make sense) and legible under all conditions of use. This article gives a fairly detailed summary of the elements of rational and legible table design, and provides illustrations of the important points.

5P, 8R

Comments

A good compact set of guidelines for basic table design, and a source of references for more complete works.

Entry Number 26

Key Words

layout
ETables In Text

BURNHILL, P., Hartley, J. and Young, M.
Applied Ergonomics, 1976, 7(1), 13-18.

Description

Three hundred and forty students aged 12-14 were asked to scan a 4-page article in which the text was printed in either a single wide column or in two smaller columns, and tables the width of the single wide column were inserted in various positions. Subjects were able to scan the single wide column better than the double columns, and about 75% reported a preference for the single-column layout. The authors suggest that line length must not be determined by type size alone, but also by the size and position requirements of non-textual material.

6P, 5R

Comments

This could be useful for production people as it contains some interesting points about layout.

Entry Number 27

Key Words

passive voice
technical writing
A

The Passive Voice Should Be Avoided - Sometimes

BUSH, D.

Proceedings of the 27th International Technical
Communication Conference, 1980, 2, W-141-144.

Description

The author questions the notion that the passive voice be avoided in professional communication. Technical writing, he states, requires the use of the passive voice, and would become unmanageably cumbersome and redundant without it. Examples of situations where the passive voice is undoubtedly the best choice are given. It is concluded that both the active and passive voices are useful writing tools and should both be employed where appropriate to increase the efficiency of communication.

4P, 4R

Comments

A short but convincing argument for restoring the passive voice to a more honorable position in the minds of writers and editors.

Entry Number 28

Key Words

instructions, language
writing style
A, T

Words, Words, Words

CHAPANIS, A.
Human Factors, 1965, 1-17.

Description

Human factors engineers should be concerned with how language is used in man-machine systems. Words are meant to communicate ideas and understanding, not to display the vocabulary of the writer. Documents which are obscure and incoherent are often the sign of a pompous writer who doesn't really know what he's talking about. Numerous examples of badly-written instructions are given, with directions on how to improve them. The author suggests that future research should be concerned with the "intelligibility" of documents rather than their readability. He also points out where such research should be directed.

18P, 10R

Comments

This is "must" reading for those who want to write understandable instructions. It contains lots of practical examples, and plenty of ideas to get you thinking about how well you are using words.

Entry Number 29

Key Words

readability formulas
GReadability In Technical Writing - Principles And
Procedures

CLARK, A.K.
IEEE Transactions on Professional Communication, 1975,
PC-18(2), 67-70.

Description

Three readability formulas are described: the Fry and Dale-Chall formulas and the cloze procedure. The Fry and Dale-Chall formulas both look at "word load" (word length/familiarity) and "sentence load" (sentence length/complexity). The cloze procedure involves having the reader fill in every fifth word left blank in a text. The author suggests that instructional materials be analyzed using both the Fry and cloze procedures.

4P, 12R

Comments

This isn't particularly enlightening, except that it concentrates on applying readability formulas to technical writing situations.

Entry Number 30

Key Words

illustrations
M, EOn The Process Of Comparing Sentences Against Pictures

CLARK, H.H. and Chase, W.G.
Cognitive Psychology, 1972, 3, 472-517.

Description

A theory of how people compare information from verbal and pictorial sources is described. This theory was tested in a series of four experiments which measured how long subjects took to decide whether a sentence was a true or false description of a picture. It is argued that people make sentence-picture comparisons in several discrete stages. This involves encoding both sentences and pictures in a common abstract representation, then matching the two representations in steps. The theory was found to predict response latencies in sentence-picture comparisons.

46P, 53R

Comments

Employing the principles outlined in this article could help readers use manuals more efficiently. For example, where diagrams are described with text, coordinating these two elements so that verbal and pictorial information coding complement each other can increase the speed and ease of encoding.

Entry Number 31

Key Words

organization, paragraphs
GParagraphing In Technical Writing

COLBY, J.B.

IEEE Transactions on Professional Communication, 1977,
PC-20(1), 20-23.

Description

Here is a brief look at the characteristics of paragraphs. The different types of paragraph constructions are described with examples. How paragraphs should be organized to produce continuity of thought is discussed. The importance of the summarizing topic sentence in allowing readers to skim an article quickly and effectively is stressed.

4P, 4R

Comments

This is a good, but undetailed summary of some of the important factors to consider when constructing paragraphs.

Entry Number 32

Key Words

readability
TThe I/E Ratio - A Measure Of Comprehensibility

COLBY, J.

Technical Communication, 1981, 1st quarter, 4-11.

Description

A new comprehensibility measure called the intensional/extensional (i/e) ratio is presented. Intensional essentially refers to abstract words; extensional refers to concrete words. Dividing the number of intensional words in a passage by the number of extensional words yields the i/e ratio. More intensional than extensional words (i/e ratio greater than 1.0) indicates that the writing is difficult to read. Several rules for classifying words into the two categories are given. The i/e ratio is compared with the "fog" readability index of a number of passages. The author hopes that writers who assess the i/e ratio of their own work will try and convert abstract words into concrete ones whenever possible.

7P, 13R

Comments

The author does not believe that sentence length is an important variable in the comprehensibility of text. The i/e ratio encourages the writer to look at the words he is using, and to substitute better ones where necessary. This is not an established measure and the author asks readers to join him in objectively testing this new device.

Entry Number 33

Key Words

typography
E

Reader Preference For Typefaces

COOPER, M.B., Daglish, H.N. and Adams, J.A.
Applied Ergonomics, 1979, 66-70.

Description

One hundred and twenty-five report readers and 57 trainee technicians at the British Post Office Research Centre took part in a study on typeface preference. A typical research report was prepared in seven typefaces in 9- or 10-point size, five of which were serif designs and two sans-serif designs. Subjects ranked each typeface according to overall preference. Those typefaces with the largest apparent size (or X-height) were preferred.

5P, 7R

Comments

There is no discussion of the reasons why readers preferred the typefaces that they did. The results probably do not bear much practical relevance to manual production.

Entry Number 34

Key Words

design, graphs
EA Study Of Graph Comprehension Difficulties

CULBERTSON, H.M. and Powers, R.D.
Audio-Visual Communication Review, 1959, 97-110.

Description

This study looks at how certain aspects of graphs make graphs easier or more difficult to comprehend. Eleven variables were included; comparisons involved 2 graphs each of which differed on only one variable. The results are discussed in detail and are summarized.

14P, 8R

Comments

There hasn't been much research on graphs, so this study still stands as an important reference.

Entry Number 35

Key Words

instructional design
A, TMathetics

DAVIES, I.K. in Davies, I. and Hartley, J. (Eds.)
Contributions to an Educational Technology. London:
The Camelot Press Ltd., 1972.

Description

Mathetics is defined as the technology of education. The basic problems of educational technology are seen as determining what steps a student must take to acquire the desired knowledge or skill and then creating a learning environment in which he will take these steps. Learning in adults is seen as the novel sequencing of behaviours which are already part of a person's behavioural repertoire. Steps for planning, writing, editing, and evaluating an instructional exercise using mathetics theory are given in some detail.

11P, 6R

Comments

This tends to get a bit technical since mathetics involves behaviour theory, and the author goes into some detail on it. But there are good suggestions in here on sequencing instructional content and keeping up reader interest, if one is willing to wade through a bit of jargon.

Entry Number 36

Key Words

programmed instruction
teaching strategies
A, G

Presentation Strategies

DAVIES, I.K. in Hartley, J. (Ed.)
Strategies For Programmed Instruction: An Educational
Technology. London: Butterworth and Co. (Publishers)
Ltd., 1972.

Description

Two major approaches to teaching based on differing views of the nature of learning are described. These are known as stimulus-centered strategies and response-centered strategies. Stimulus-centered strategies tend to concentrate on the needs of the individual, allowing him greater freedom to exercise his own learning strategies, but including some type of criterion test to ensure that learning objectives have been met. Response-centered strategies are based on principles of conditioning, and the presentation of information is highly structured. Five broad structures of behaviour which characterize different learning situations are described. The objectives of the learning situation are manifested in these behaviours, and it is shown how particular types of teaching structures are best suited to the different behaviours. The types and uses of frames (connected units of information designed to bring about behavioural objectives by increments) are discussed. A sample teaching program on how to discriminate a normal and an abnormal electrocardiogram is shown.

51P, 385R in book

Comments

Though various instructional strategies are discussed, the emphasis is on programmed instruction and the writing of frames.

Entry Number 37

Key Words

task analysis

A

Task Analysis

DAVIES, I.K.

Audio-Visual Communication Review, 1973, 21(1), 73-86.

Description

Task analysis involves gathering information about a proposed instructional situation in order to better design a learning environment in which the instructional objectives can be met. The elements of task analysis are examined in detail in this paper. Three approaches to task analysis which reflect the maturational stages of the social sciences are described. The first is the technical approach, which assumes man to be a passive instrument of the learning environment, and which attempts to "fit the student to the task". The second is the human relations approach which acknowledges the needs of the individual and attempts to "fit the task to the student". The final approach, sociotechnical, is a combination of the first two, and seeks a balance between task objectives and human needs.

14P, 47R

Comments

The basic premise of this paper is that instructional designers must take a systems approach to their task. They must attempt to integrate human and technical factors under the demands of the situation to create optimal learning conditions. The steps given for carrying this out are general in nature, but may be of practical guidance.

Entry Number 38

Key Words

evaluation
technical writing
T

Experimental Research In The Effectiveness Of Technical Writing

DAVIS, R.M.

IEEE Transactions on Engineering Writing and Speech,
1967, 10(2), 33-38.

Description

Too often, texts on technical writing contain guidelines based on "common sense" or common practice rather than on experimentally-validated findings. As well, these guidelines tend to be too vague for specific application, i.e. the writer is told to use the rules in a way which suits the situation, but is not told how to do this. This article describes an experimental method designed to test the effects of varying certain elements of technical material on the effectiveness of that material. The results obtained from performing experiments using the method are meant to form the basis of guidelines. Although not all possible communication situations can be examined experimentally, generalizations can often be made from a tested situation to others which are similar.

6P, 3R

Comments

What is described is a factorial design. Three experiments using this design are shown to produce useful, reliable results, indicating that the method is a workable way of determining better ways to present instructional material to certain audiences for particular purposes.

Entry Number 39

Key Words

documentation
usability, user needs
G

Making Written Information Fit Workers' Purposes

DIEHL, W. and Mikulecky, L.
IEEE Transactions on Professional Communication, 1981,
PC-24(1), 5-9.

Description

Writers must know the purposes for which workers will use documentation, as this should affect the way the material is designed. Three types of reading tasks have been identified by research: reading-to-do, reading-to-learn, and reading-to-assess. Reading-to-do material is used as a reference and is applied directly to a job task; reading-to-learn material is intended to be used away from the actual application and is stored in memory; reading-to-assess material is skimmed to determine its future usefulness to the reader or to others. This article contains suggestions for making each type of material more usable, and discusses situations where material should be designed to serve all three purposes.

5P, 12R

Comments

Practical suggestions for determining how material will be used, and thus how to best design it are provided. Special features which increase the usability of the different types of material are outlined. A checklist for document improvement is given at the end of the article.

Entry Number 40

Key Words

computer models, naive users
A, T

The Black Box Inside The Glass Box: Presenting
Computing Concepts to Novices

DUBOULAY, B., O'Shea, T. and Monk, J.
International Journal of Man-Machine Studies, 1981,
14, 237-249.

Description

This article argues that novices should learn to program in a simple beginners language. The complexity of the language reflects the complexity of the machine the language is meant to control. Thus a simple notional computer, the idealized model of the computer implied by the constraints of the programming language, should be used for teaching purposes. The argument that a simple teaching language is preferable to a subset of an existing language is based on numerous examples of the sorts of problems encountered and types of errors made by new users. Simplicity of operation (through limitation of the capability of the notional machine) and visibility of only those aspects of the notional machine necessary to use and understand the language are emphasized. Three sample programming systems are described which have been developed for different populations of novices.

13P, 32R

Comments

The article is restricted to a discussion of instructing in the use of programming languages, but can be interpreted in the broader context of instruction about computer systems in general. It supports the idea that computer users should have at least a basic understanding of how their computer works rather than just knowing what sequence of button presses provides a desired result. Such understanding can provide the basis for problem-solving competency, thus increasing efficiency of use.

Entry Number 41

Key Words

illustrations

A

Research On Illustrations In Text

DUCHADEL, P.C.

Educational Communication and Technology Journal,
1980, 28(4), 283-287.

Description

In general, research on the use of illustrations in text has not shown them to facilitate learning. The author contends that this research has been too general, and as such is misleading. There are many factors which must be considered when choosing illustrations such as the appropriateness of the illustration, the type of prose illustrated, and the sophistication of the readers. All types of pictures will not facilitate learning in all situations, and some may even hinder learning. Researchers must be aware of the sensitivity of results to even slight changes in the conditions of use. The author stresses that pictures should be classified and studied according to what function they serve rather than how they look. Two different functional approaches are referenced.

5P, 20R

Comments

This article brings up some very good points about why past research has been unsupportive of illustrations. It also points the way to a more meaningful approach to research, and gives some useful references.

Entry Number 42

Key Words

programmed instruction
task analysis
T

Strategies For Analysis Of The Task

DUNCAN, K. in Hartley, J. (Ed.)
Strategies for Programmed Instruction: An Educational
Technology. London: Butterworth & Co. (Publishers)
Ltd., 1972.

Description

The first step in designing instructional materials is an analysis of what is to be learned and how this is to be accomplished. A task analysis should provide precise objectives and a test to measure the attainment of these objectives, a detailed statement of the behaviours essential to mastering what is to be learned, and a plan for how students may best be taught the material. This paper looks at several approaches to this problem which have been used in military and industrial settings. In what is seen as the best approach, two considerations play a major role in determining what behaviours are essential to mastery. These considerations are: 1) the probability of inadequate performance without education or training, and 2) the costs to the system of inadequate training. The author stresses that a properly-performed task analysis can yield more benefits in the learning situation than can the use of expensive instructional hardware.

63P, approx. 375R in book

Comments

A sample task analysis in an industrial setting provides practical examples of the concepts discussed.

Entry Number 43

Key Words

illustrations
G, M, E

A Guide For Improving Visualized Instruction

DWYER, F.M.

State College, Pennsylvania: Learning Services, 1972.

Description

Visual illustrations are not usually chosen for their instructive value, but for subjective reasons of the designer or for economic reasons. Instructors need guidelines to be able to choose wisely from the vast array of visual material presently available. 6,546 students were tested in a number of studies designed to produce such guidelines. Variables tested were use/non-use of visuals, amount of realistic detail of visuals, use/non-use of colour. Visuals presented ranged from black and white line drawings to colour photographs. Four criterion measures were used to test effectiveness of visual types. For each study the author determined which visual was most effective by assessing instructional effectiveness, economy and simplicity of production. Where several types of visual provide equivalent learning benefits, the one which is easiest and cheapest to produce is chosen as most effective. The effectiveness of visual material depends on the characteristics of the audience, the educational objectives, the method of presentation, the type of visual, and the techniques used to point to the important learning cues. The author suggests that organizations determine for themselves through experimentation which combinations of these factors produce the most effective instructional situation.

138P, 104R

Comments

Most of the results presented here are general in nature, and would therefore not be of practical use to designers. However, the necessary factors to consider when trying to determine what type of illustration to use in various situations can be found here, and a useful model for experimentation is given.

Entry Number 44

Key Words

naive user

A

Understanding The Naive Computer User

EASON, K.D.

Computer Journal, 1976, 19(1), 3-7.

Description

Designers of computer systems must cope with making their product usable by an ever-widening variety of people. This paper briefly discusses general attributes of naive computer users, i.e. those persons who use computer systems to help do their jobs, but who are not experts in computer technology. The differences in behaviour among naive computer users are said to stem mainly from factors associated with their jobs and their positions. Six of these factors are discussed.

5P, 8R

Comments

Although documentation is not specifically discussed, writers may be able to benefit from this article. The approach taken here has an advantage over those which emphasize personality variables in users. Personality factors vary widely within user groups, but job factors are fairly stable and can give the writer a more consistent picture of his audience. No guidelines are given for dealing with these factors, but research directions are suggested.

Entry Number 45

Key Words

illustrations

R

On Pictures In Educational Research

FLEMING, M.L.

Instructional Science, 1979, 8, 235-251.

Description

This is a selective review of research on instructional pictures which has been done within the past 20 years. There is a brief historical overview which shows the changes in research emphasis and refinements in methodology which have taken place. The actual studies are divided into three sections: pictures vs pictures, pictures vs words, and pictures plus words, according to the type of questions being asked in each study. Studies are referenced which indicate the superiority of certain types of pictures over other types, pictures over words, words over pictures, and pictures plus words over either pictures or words. The main point is that the effectiveness of all these combinations depends on the situation in which they are used. The author concludes that pictures play an integral part in instruction, especially in interaction with verbal information.

17P, 60R

Comments

This recent article does not provide an exhaustive review of the research on pictures, but does seem to present a representative sample of research results. There are no conclusions made in the form of practical guidelines.

Entry Number 46

Key Words

attitude change, concept learning
instructional design, memory, perception
A, G

Instructional Message Design

FLEMING, M. and Levie, W.H.
Englewood Cliffs, N.J.: Educational Message Design,
1978.

Description

This book is an attempt to bring together behavioural science principles in such a way as to make them useful to those involved in instructional message design. The book is divided into four sections: perception principles, memory principles, concept learning principles, and attitude change principles. In each section a basic introduction to the area is given, followed by 30-60 statements or principles which have been experimentally validated. Each of the principles is explained in detail and the conditions under which it holds are described. Some of the topics covered are the role of attention in perception, qualities of text and graphics which enhance perception and memory, the special factors involved in acquiring problem-solving capabilities and other types of conceptual learning, and the role of credibility and persuasion in attitude change. Throughout the book, the role of individual differences is also addressed.

289P, 205R

Comments

This book is unique in its purpose. It is an attempt to arm instructional designers with principles of human behaviour which they can use to produce more effective teaching programs and materials. However, as the authors state, it does not replace or lessen the need for innovation in instruction.

Entry Number 47

Key Words

readability,
rhetoric, writing style
A, G

The Art Of Readable Writing

FLESCHE, R.
New York: Harper and Row, 1948.

Description

The author recommends the use of a "modern, scientific rhetoric" based on writing in a language and style suitable for modern-day audiences. Old rules of grammar and sentence construction based on Aristotelian principles are criticized as dry and pompous, even a barrier to true communication. The writer is urged to find out who his readers are and what they know before deciding how and what to try and tell them. Many suggestions are given on how to develop a style of writing which pleases readers while informing them effectively. The last chapter describes the author's famous readability formula, and how to use it.

237P, Several References

Comments

This is very enjoyable reading and contains a lot of helpful hints. There is a plethora of examples taken from the works of famous writers and from newspapers, magazines, etc. to illustrate the heights and depths of communication. Although not geared toward technical writing it has a lot to say about humanizing communication.

Entry Number 48

Key Words

adjunct aids, advance organizers
organization, examples

A

Reducing Manual Labor: An Experimental Analysis of
Learning Aids for a Text-Editor.

Foss, D., Rosson, M. B., & Smith, P. Proceedings of
Human Factors in Computer Systems, Gaithersburg,
Maryland, 1982, 332-336.

Description

Time, number of errors, and other measures were recorded for novice computer users attempting to use a line-oriented text editor in a 2 x 2 factorial experiment. The factors were type of manual (standard and modified) and whether or not an advance organizer was used. The standard reference manual differed from the modified manual in several ways. Information about a given command was given all at once and in an abstract notation. The modified manual contained the same information, but simple forms of commands were presented first, using concrete examples. The advance organizer, read by half the subjects in each group, used analogies to explain basic characteristics of the computer and editor. There was a large significant difference due to the manual type and a marginal difference due to advance organizers. It is concluded that organization of the manual has dramatic effects on new user performance. The less dramatic effect of the advance organizer was attributed to its content--the concepts covered were not those most needed. The authors conclude that guidelines are needed to indicate in advance what to include in an advance organizer.

5P,11R

Comments

The authors acknowledge that the two manuals differ in a number of attributes other than just organization. Unfortunately, they tend to ignore this difficulty in their discussion. Clearly, they have shown that their modified manual was superior, but any number of factors could account for that difference.

Entry Number 49

Key Words

typography, visual cueing
E, R

The Use Of Visual Cues In Text

FOSTER, J.J. in Kolers, P., Wrolstad, M.,
and Bouma, H. (Eds.) Processing of Visible Language (I).
New York: Plenum
Press, 1979.

Description

This article looks at how visual (typographic) cueing can facilitate effective reading by signalling the underlying structure of text. The previous research in this area is reviewed. Two experiments are described. The first experiment involved 26 subjects who were told to read through a passage and underline not more than 16 sentences (condition A) or not more than 8 sentences (condition B) which they considered to be most central. Within each condition, there was found to be very little agreement between subjects on which sentences were chosen. The second experiment had three conditions: 1) 16 core sentences set in capitals, 2) 16 randomly-chosen sentences set in capitals, 3) no sentence cueing. Subjects in the first group (given relevant cues) recalled more core material than did subjects in either of the other two groups. It was concluded that visual cueing can promote effective reading as long as it is core content which is cued. The author suggests that future research be directed towards developing techniques identifying key sections of text (for cueing) and determining how much material in a text should be cued.

15P, 30R

Comments

It is reasonable to think that other types of cueing (bold, italic, etc.) could have similar effects to that of capitals. It appears that even if one cannot identify exactly which sections of a text should be cued, cueing that information which is judged to be central can be helpful. This is a good review of previous research in the area of cueing.

Entry Number 50

Key Words

typography, visual cueing
EAn Experimental Study Of Typographic Cueing In
Printed TextFOSTER, J. and Coles, P.
Ergonomics, 1977, 20(1), 57-66.

Description

Ten statements from a 61-statement passage of scientific text were selected as being most central to the passage by 10 independent judges. These statements were then "cued" by setting in boldface or uppercase type within the regular body of the text. Pre-test effect was included as a variable in three conditions: pre-test of cued information, pre-test of non-cued information, and no pre-test. One hundred and eighty polytechnic students read one of the two cued texts or an uncued (control) text. All subjects then received a post-test. Both types of cueing were found to be beneficial under certain conditions of pre-testing. Explanations are offered, and the implications of the results are clarified.

10P, 14R

Comments

This paper takes a good look at some previous research in the introduction. The methods of cueing looked at here (boldface and capitals) are less expensive to produce than those which many studies concentrate on (underlining and color coding), and as such may be of more practical interest to designers.

Entry Number 51

Key Words

visual cueing
EEffectiveness Of Highlighting For Retention
of Text Material

FOWLER, R.L. and Barker, A.S.
Journal of Applied Psychology, 1974, 59(3), 358-364.

Description

Four groups of 19 students studied scientific articles for one hour, during which one group was told to use a highlighter pen on material they wished to emphasize (active highlighting condition). Another group was yoked to the first group, and studied from the copies which these students had highlighted (passive highlighting condition). The third group studied materials highlighted by the experimenter (experimenter-highlighting condition), and the fourth group studied unhighlighted text (control). In a second experiment, red underlining, yellow highlighting and no emphasis conditions were compared using 24 subjects. The results indicated that underlining and highlighting worked equally well to increase retention. Active highlighting was more effective than the passive highlighting or control conditions, but passive highlighting may help some readers retain information, especially if they believe that the person who emphasized the material was a high achiever.

7P, 12R

Comments

This may apply to the use of various cueing techniques in the production of manuals. However, less expensive techniques of cueing (capitals, boldface) have been found to be equally effective as the methods used here.

Entry Number 52

Key Words

instruction
modules
T

Modular Instruction: Its Structure, Operation And
Implications

FRALEY, L.E. and Vargas, E.A.
Journal of Technical Writing and Communication, 1976,
6(1), 57-70.

Description

The benefits of a modular approach to instruction are expounded. The method emphasizes breaking learning material into small, sequential components which lead to proficiency on predetermined criteria. Methods of constructing pretests and posttests for modules are described and the method in which the pretest/posttest results of a small sample of users are used to evaluate the effectiveness of the module is described. References to more detailed articles are given.

14P, 8R

Comments

This article gives a clear statement of the "pro-module" viewpoint with some advice on how to test and evaluate modules also provided. It is indicated that testing of a small group of subjects will lead to detection of problems. The use of pretests and posttests in manuals may not be useful to evaluate the knowledge of users. However, they could be extremely useful to the writer in assessing the adequacy of the document.

Entry Number 53

Key Words

typography, visual cueing
ETypographical Cues That Facilitate Comprehension

FRASE, L.T. and Schwartz, B.J.
Journal of Educational Psychology, 1979, 71(2),
197-206.

Description

The effects of segmenting and indenting sections of text by meaning was tested. Subjects read texts which were arranged to maximize and minimize meaningful segmentation and indentation cues, then were asked to verify a sentence dealing with the text. A combination of meaningful segmentation and indentation led to faster response times than were found with standard text. The question is raised as to whether meaningful segmentation can assist in the learning process as well as in comprehension while scanning. The authors feel that concentrating on line length and margin justification isn't as useful as ensuring that each line represents a meaningful unit of information.

10P, 16R

Comments

This article could have implications for the design of teaching material, although it would seem that segmenting and indenting information down to the level of phrases within sentences (as is done here) could be a costly and time-consuming process. The individual experiments involved very few subjects, and as such, the conclusions should be assessed carefully before being applied.

Entry Number 54

Key Words

documentation, evaluation
feedback
T

A Feedback Procedure For Technical Documentation

GIBSON, K.M.

Proceedings of the 27th International Technical
Communication Conference, 1980, 1, M-87-93.

Description

This paper is an account of how Bell Laboratories set up and implemented a feedback system for evaluating and revising documentation. It describes the uses and mechanics of the system, and also offers suggestions on how other organizations can set up a similar program. There are detailed illustrations of the actual reply card, instructions for the editor and printer, and tally sheets for the data.

7P, OR

Comments

Where such a feedback evaluation system is considered to be desirable, this paper can provide good guidelines for designing and producing it.

Entry Number 55

Key Words

instructional objectives
user needs
A

Praxeonomy: A Systematic Approach To Identifying
Training Needs

GILBERT, T.F. in Davies, I. and Hartley, J. (Eds.)
Contributions To An Educational Technology. London:
Butterworth and Co. (Publishers) Ltd., 1972.

Description

The author introduces four rules to determine what training objectives are essential in particular training situations to provide the most efficient program of instruction. Instructional objectives should be based on the deficiencies of students, and these deficiencies should be measured directly. Standard achievement tests do not tell us where deficiencies lie. Rather, they tend to measure the end result of the integration of many skills, and can thus make a person who lacks knowledge in one small but important area look vastly incompetent. Also, deficiency in knowledge must be distinguished from deficiency in the application of that knowledge. Finally, the value of overcoming a deficiency must be weighed against the cost in time and money of doing so.

20P, OR

Comments

An analysis of the skill level of an intended user group could help clarify to the manual writer what content to include and at what level. However, such an analysis may be too costly for many documentation firms to carry out.

Entry Number 56

Key Words

readability
reader characteristics
A

Readability

GILLILAND, J.

London: University of London Press Ltd., 1972.

Description

Readability is here seen as involving a match between reader and text; readable material is readily understood, can be read at optimum speed, and is interesting. Characteristics of the reader and the text which interact to determine readability are examined. These include reader interest and motivation, legibility of text, and four chapters devoted to units of language and how meaning is derived from them. The major methods for assessing readability are described and evaluated. The author has compiled an annotated bibliography containing 16 works on readability which he feels are representative and worth reading.

128P, 72R

Comments

This is a fairly recent look at readability, and is meant to serve as an introduction to the subject. The annotated bibliography is short, but good. Some useful suggestions for improving readability can be found here.

Entry Number 57

Key Words

instructional objectives
typography, visual cueing
E

Control Of Prose Processing Via Instructional And
Typographical Cues

GLYNN, S.M. and DiVesta, F.J.
Journal of Educational Psychology, 1979, 71(5),
595-603.

Description

Instructional and typographical cueing systems were used to accentuate material in prose text on which subjects were later tested. The conditions under which the two systems (instructional objectives and underlining) were most effective in enhancing recall for 176 subjects are outlined. Essentially, underlining was more effective than instructional objectives, presumably because it was easier to use. Several recommendations for the effective use of cueing systems are given. Instructors are warned to use texts with cueing systems which reflect their teaching objectives, since competing cues can disrupt the learning process.

9P, 20R

Comments

In light of these results, the instructional designer may not choose to include in a manual instructional objectives for the student's use. Typographical cueing may be more effective for this purpose. However, instructional objectives could still be a valuable in-house tool for assessing how well a manual carries out its intended purpose.

Entry Number 58

Key Words

documentation, skills
technical writing
T

Skills Behind Skills - Technical Writing For
Documentation

GOFF, V.L.
Data Management, 1979, 17-19.

Description

Technical writers should possess at least two of three required skills: knowledge of the business for which a document is being prepared, writing and editing skills, and data processing skills. A system for coordinating the skills of writers, programmers and editors is discussed. The importance of addressing user needs is emphasized, and the use of a "run book" for purposes of assessing the system is outlined.

3P, OR

Comments

This paper shows an understanding of management principles and sensitivity for the needs of documentation team members.

Entry Number 59

Key Words

documentation, standards
guidelines
A, G

EDP User Documentation: The Missing Link

GRIMM, S.J.

IEEE Transactions on Professional Communication, 1981,
PC-24(2), 79-83.

Description

User documentation is often written by programmers who are not interested or skilled in writing. A user documentation writer must be able to write clearly for the user, as well as have sufficient technical knowledge to understand the equipment he is describing. The usefulness of having a set of standards to assist in the writing process is pointed out. Eleven areas which should have standards are discussed in some detail, and suggestions are made as to what form the standards might take.

5P, OR

Comments

This is not a source of standards but simply some guidelines for where standards must be established by those who produce manuals.

Entry Number 60

Key Words

readability, readability formulas
writing style
G

The Technique Of Clear Writing

GUNNING, R.
New York: McGraw Hill, 1952.

Description

This book is based on the idea that although writing is an art, there are some established principles which can be followed to create clear, effective writing. The author describes his readability measure, the "fog index", and how to apply it. Ten principles for achieving a clear writing style are presented, each in a separate chapter. There is a chapter on technical writing in which some of the difficulties specific to this area of communication are discussed. There is a list of 3,000 familiar words given in an appendix, and a list of simple substitutions for complex words in another appendix.

289P, OR

Comments

This is a 30-year-old book, but what it says is still very useful. The author takes a common-sense approach to writing, and acknowledges that writing cannot be reduced to a simple set of rules. He recommends the thoughtful use of a set of principles to be built into one's own writing style.

Entry Number 61

Key Words

analogy, models
metaphor, novice
A

Analogy Considered Harmful

HALASZ, F. & Moran, T. P.
Proceedings of Human Factors in Computer Systems,
Gaithersburg, Maryland, 1982, 383-386.

Description

Use of analogies to teach new users of computer systems can be dangerous. Users tend to reason about the new system on the basis of the analogy. This is because the analogy is not sufficient to completely explain the computer system, which is unique. That is, there are things about the computer that the analogy does not cover, and there are things in the analogy that do not have anything to do with the computer system. The authors argue that these problems can be avoided by using abstract computer models to present the conceptual foundation to the user, and that analogy should only be used as a "literary metaphor" to convey a single point. Its purpose is to "provide contact with the user's prior knowledge", not to give the user "a whole system of thought".

4P,8R

Comments

This article calls attention to an important limitation of the use of analogy. However, the solutions as proposed, do not seem very realistic. As the authors admit, the use of abstract models without concrete reference is not very effective with novice computer users. On the other hand, they do not suggest ways of presenting an analogy which will restrict its use by the novice.

Entry Number 62

Key Words

design, evaluation
 layout, typography
 G

Designing Instructional Text

HARTLEY, J.
 New York: Kogan Page, 1978.

Description

This book summarizes in detail the physical aspects of presenting textual information. Each chapter deals with specific considerations, describing current practice and research findings and ending with a set of guidelines. There is information on how to choose an appropriate page size and how to arrange text and illustrations on the page. Do's and don't's for constructing prose text are given, and some alternatives to prose are discussed. Directions for choosing type style are given, as well as type size and line spacing. There is a brief chapter on programmed instruction. The concluding chapter discusses the problem of evaluating instructional text in terms of content, readability and teaching effectiveness. The author emphasizes the need for planning the design of instructional text before actually producing it, in order to achieve consistency and maximum effectiveness.

124P, 83R

Comments

Most of this book is devoted to concerns of typography and layout and as such may be of use to those in charge of the production of manuals. Writers will find some useful information on effective prose usage and alternatives to prose. There are several "before and after" examples of excerpts of instructional text which nicely illustrate the use of the principles given in the book. The chapter on evaluating instructional text could be very useful in document writing. (See Kinrose, 1979, entry #77).

Entry Number 63

Key Words

graphics, prose
typography
G

Eighty Ways of Improving Instructional Text

HARTLEY, J.
IEEE Transactions on Professional Communication, 1981,
PC-24(1), 17-27.

Description

These guidelines have been carefully prepared from the results of research in various aspects of prose structure, graphics and typography. The reader is cautioned to assess the suggestions carefully before applying them in particular situations which may differ markedly from the situations in which they were originally found to be valid.

11P, 85R

Comments

This contains information similar to that found in Hartley's (1978) book (see entry #59), along with several more recent references. However, the book contains much greater detail and includes many useful examples.

Entry Number 64

Key Words

programmed instruction

A

Evaluating Instructional Methods

HARTLEY, J. in Davies, I. and Hartley, J. (Eds.)
Contributions To An Educational Technology. London:
Butterworth and Co. (Publishers) Ltd., 1972.

Description

The results of 112 studies comparing the effectiveness of programmed instruction versus conventional instruction are pooled. Although it would appear that programmed instruction can teach some things as effectively (or more effectively) and often in less time than can conventional instruction, this may be misleading. Many studies have used small numbers of subjects and short programs, and have not provided sufficient detail of how data was collected and analyzed. As well, the overrepresentation in journals of studies showing positive results could bias conclusions. Studies in which teacher and program work together have shown this combination to be more effective than either taken separately.

4P, 8R

Comments

Unfortunately, it is not made clear what subject matter was being taught in the various studies, so it is impossible to draw any conclusions from this paper as to whether programmed instruction is more or less effective than conventional instruction for teaching technical material.

Entry Number 65

Key Words

evaluation
programmed instruction
T

Evaluation

HARTLEY, J. in Hartley, J. (Ed.)
Strategies For Programmed Instruction: An Educational
Technology. London: Butterworth and Co. (Publishers)
Ltd., 1972.

Description

Three types of evaluation associated with programmed instruction are discussed. The first deals with measuring proficiency, i.e. how well a student has achieved the instructional objectives associated with a program. The development of such tests, and their reliability and validity are discussed. The second type of evaluation deals with assessing programs to determine their effectiveness as teaching instruments. Developmental testing is an ongoing process throughout the development of a program, and involves user test trials and revisions. Field testing is done after developmental testing has been used to refine a program as much as possible. The types of measures taken and problems to look for in field trials are discussed. The third area is revision, which involves improving a program which has already been field tested and found to be effective. The author compares programmed instruction with conventional instruction to assess the benefits in terms of cost, time and effectiveness.

41P, 385R in book

Comments

This article would be very helpful in developing an effective instructional program. It also provides many references to material which covers the topic in even greater detail.

Entry Number 66

Key Words

layout
A, TSpace And Structure In Instructional Text

HARTLEY, J. in Hartley, J. (Ed.)
The Psychology of Written Communication. London:
Kogan Page Ltd., 1980.

Description

Research in the design of instructional text has concentrated on such details as typeface, typesize, line length, etc. and has failed to look at how the overall layout of a page affects comprehension and ease of use. The main point of this paper is that legibility of text depends primarily on how well white space is used on the page. It is shown how the thoughtful use of vertical and horizontal spacing can increase legibility. Also, it is suggested that the process of designing an effective spatial structure often leads to changing the content of text so that it is clearer. Three case examples of how texts were revised are given. It was found through experimentation that subjects preferred the revised versions, and were able to use them more efficiently than the original versions. The author acknowledges that there are numerous variations in design that he has not assessed, and that the studies he has done are affected by the limitations of the experimental setting. He advocates the use of field studies and "unobtrusive measures".

18P, 19R

Comments

Professional layout artists acknowledge that "what isn't there" is often as important as "what is there". However, many articles written on the subject stress the design of what is put on the page, missing the importance of white space. This is a very useful article.

Entry Number 67

Key Words

programmed instruction
TWriting A Program: A Case History

HARTLEY, J. in Hartley, J. (Ed.)
Strategies For Programmed Instruction: An Educational
Technology. London: Butterworth and Co., 1972.

Description

This is an account of the writing of an actual program of instruction designed to teach students to interpret traffic signs. The general procedure for writing programmed instruction materials is outlined, with examples of how these steps were implemented for the traffic sign program. Techniques for evaluating the program are included. Programmed materials in textbooks were found to present a problem since people tended to flip back and forth through the book rather than use it in the intended sequential manner.

12P, 7R

Comments

Although the subject matter of this particular program is perhaps not as complex as that involved in learning to operate computerized equipment, the methods used here may still be of some practical assistance.

Entry Number 68

Key Words

advance organizers,
behavioural objectives, overviews, pretests
G, R

Preinstructional Strategies: The Role Of Pretests,
Behavioral Objectives, Overviews And Advance Organizers

HARTLEY, J. and Davies, I.K.

Review of Educational Research, 1976, 46(2), 239-265.

Description

Preinstructional strategies have been widely used to aid the instructional process. Four types of preinstructional strategies (pretests, stating behavioural objectives, providing overviews, and advance organizers) are defined, examples of each are given, and distinctions among the four are clarified. A thorough review of the research literature on these four techniques is included and a set of guidelines are provided. Basically, the utility of different forms is heavily dependent on the learning task and user characteristics. The guidelines are to use a pretest when students need to be alerted as to what they do not know, behavioural objectives when they need to know what to accomplish, overviews when students need to be prepared for an unstructured task, and advance organizers when a conceptual framework is required.

25P, 98R

Comments

This is a good introduction to the four major types of preinstructional strategies. The main finding of this article is that a preinstructional strategy may or may not be effective, and thus it may not offer much of practical use to technical writers. Also, there are no guidelines on how to construct preinstructional strategies, nor are any examples of such strategies given.

Entry Number 69

Key Words

typography
B

A Selected Bibliography Of Typographical Research
Relevant To The Production Of Instructional Material

HARTLEY, J., Fraser, S. and Burnhill, P.
Audio-Visual Communication Review, 1974, 22(2),
181-190.

Description

This bibliography contains over 100 entries relevant to typographical design of instructional material. The authors have classified material under several headings such as overviews, bibliographies, research issues and standards. Within these areas, they have sought to choose the most inclusive and up-to-date articles and books rather than providing an exhaustive list of works.

10P, over 100 references

Comments

The senior author is one of the more prolific writers in the area of instructional design; thus this is likely to be a good representation of relevant material in the area up until 1973.

Entry Number 70

Key Words

summaries
EThe Role And Position Of Summaries: Some Issues And Data

HARTLEY, J., Goldie, M. and Steen, L.
Educational Review, 1979, 31(1), 59-65.

Description

Summaries can be placed either before or after an article, and they have three basic functions: to help the reader decide whether or not to read the article, to help the reader organize his thoughts about what is to come, and to review the important features of the article. The first two functions dictate that the summary be placed before the article, and the final function can be carried out in either position. This paper describes a study in which 42 subjects read a 1000-word passage with a summary reviewing the important points of the passage. There were 3 experimental conditions: 1) summary before, 2) summary after, and 3) no summary. It was found that subjects who read the summary after the passage performed better on a posttest. The authors caution that these results do not show that summaries should always be placed after text. Different types of summaries and different types of text could yield contradictory results.

7P, 16R

Comments

This paper was meant to stimulate research on summaries. It is not a source of guidelines for writing and positioning summaries, although it offers some worthwhile points to consider.

Entry Number 71

Key Words

typography
visual cueing
E

Typographical Cueing In Conventional And Programmed
Text

HERSHBERGER, W.A. and Terry, D.F.
Journal of Applied Psychology, 1965, 49(1), 55-60.

Description

Simple and complex typographical cueing was used in conventional and programmed texts to determine effectiveness in enhancing learning. Typographical cueing involved distinguishing important from unimportant content. The simple version used a dichotomous cue (black vs. red ink) and the complex version combined color of ink with upper/lower case type and underlining to make finer distinctions. Programmed text employs quiz sheets which the student uses periodically to check his progress. Simple typographical cueing was found to be effective in both conventional and programmed text, but complex cueing was ineffective. Programmed text was found to be superior to conventional text. The authors conclude that simple typographical cueing and quizzing in programmed text are independently effective, and may be combined to obtain the benefits of both.

6P, 11R

Comments

This may be of help in deciding how to stress certain information in manuals. The authors suggest that a certain level of learning can be achieved via typographical cueing alone, but that greater advantages can be achieved using self-test items in a programmed text. Writers may want to consider whether the time and effort involved in constructing a programmed text are worth the advantages gained over the use of typographical cueing alone.

Entry Number 72

Key Words

documentation, standards
M, R

Structured Writing - An Approach To The Documentation
Of Computer Software

HORN, R.E. and Kelly, J.N.

Association for Computing Machinery, Special Interest
Group for Systems Documentation, (ACM SIGDOC) Asterisk,
1981, 7(4), 4-25.

Description

This article introduces a methodology for documenting computer software called "structured writing". Structured writing is based on a set of standards devised by the authors which determine the format of the document, how information is segmented, choice of writing style, typeface, sentence length and word choice, and choice of graphics. Current documentation problems are discussed, followed by a look at how a structured writing approach can solve many of the problems. In six studies subjects learned information faster and more completely from structured writing passages than from conventional prose (5 studies) or programmed instruction (1 study). Writers also benefit from a structured writing approach as it helps clarify what information should be given and how it can be most clearly written. Benefits in terms of cost to the producer and the buyer are also outlined. Finally, several examples are given which show typical pages from a user manual converted to structured writing versions.

22P, 6R

Comments

The guidelines for structured writing are not available in this paper, but can likely be purchased from the authors whose address is included. Also, many of the references are unpublished theses. The article itself serves as an example of structured writing and as such proves to be quite effective.

Entry Number 73

Key Words

design, documentation
usability
G

What Is Good Documentation?

HOWARD, J.
Byte, 1981, March, 132-150.

Description

Documentation is seen as involving more than just technical writing. The many aspects of producing usable documents are gathered under the term "information design". Three major areas of information design are discussed: content, organization and format. Under content, a diagrammatic method for determining the breadth, depth and consistency of a piece of writing is introduced. Topics included under organization are indexing and headings, grouping and sequencing, routing within the document, and introductions and reviews. Format is discussed in terms of designing illustrations and text in a way which promotes coordination of spatial and verbal learning.

9P, OR

Comments

There are several innovative ideas in this paper. The section on making words and pictures work together is particularly interesting.

Entry Number 74

Key Words

persuasion
technical writing
A, T

Credibility And Reasoning In Technical Writing - Some
Notes For Writers, Editors, And Instructors

JORDAN, M.P.
Journal of Technical Writing and Communication, 1976,
6(1), 35-51.

Description

To accept information, readers must not only understand it but believe it as well. Communicating effectively involves persuasion, and credibility plays an important part. Methods for achieving credibility are discussed, with the most emphasis placed on logical reasoning. Technical writers are specifically addressed.

17P, 6R

Comments

The author stresses that teaching credibility and reasoning to technical writers must involve practical applications which are of interest to them professionally. However, he follows his own advice very little in this paper. There are lots of useful ideas here, but few examples of how to employ them.

Entry Number 75

Key Words

learning aids
technical manuals
E

Facilitation Of Learning From A Technical Manual: An
Exploratory Investigation

KALT, N.C. and Barrett, K.M.
Journal of Applied Psychology, 1973, 58(3), 357-361.

Description

Technical manuals should be designed so that they facilitate learning and also serve as a source of reference. In this study, a manual was designed using advance organizers, postquestions, concrete illustrations and delayed review techniques. A group of professional engineers read this manual or the same manual prepared without the above-mentioned techniques. Subjects using the manual containing the techniques were able to recall more information and to find information faster, and were more pleased with the manual than subjects using the unembellished manual. Less experienced engineers seemed to benefit more from the techniques than did their more experienced colleagues.

5P, 13R

Comments

The authors acknowledge that they regret not having had enough subjects to assess each of the four techniques separately. Their view of advance organizers as simple summaries differs from how these elusive learning aids are usually defined.

Entry Number 76

Key Words

flowcharts, format
EThe Comprehensibility Of Printed Instructions And The
Flowchart Alternative

KAMMANN, R.

Human Factors, 1975, 17(2), 183-191.

Description

Two different types of flowcharts were compared with prose instructions for dialing various types of calls. Subjects were Bell Telephone employees and housewives. Both housewives and Bell employees made fewer errors when using the flowcharts. Housewives were able to use the flowcharts faster than prose instructions, but employees used all three systems equally fast. It was concluded that flowcharts can increase speed and accuracy in real-life instructional contexts.

9P, 12R

Comments

This is a thoughtful paper which discusses its own limitations. It brings up the need to assess the effectiveness of flowchart formats.

Entry Number 77

Key Words

documentation project
managing
T

The Writer As Documentation Project Manager

KANTNER, L.E.

Proceedings of the 27th International Technical
Communications Conference, 1980, 1, M-15-19.

Description

The head writer on a documentation project is seen as the natural project manager. Projects must be planned in advance and monitored carefully throughout in order to be completed successfully and on time. Suggestions for defining the type of document and the audience, and for developing an outline are given. Ways of organizing the project into time-limited tasks are discussed, and several warning signals which indicate that a deadline may not be met are pointed out.

5P, OR

Comments

For those who want a few hints on organizing their documentation project, this could be of some help.

Entry Number 78

Key Words

instructional objectives
EInstructional Objectives As Directions To Learners

KAPLAN, R. and Rothkopf, E.Z.
Journal of Educational Psychology, 1974, 66(3),
448-456.

Description

Subjects were given general or specific objectives to learn varying amounts of instructional points in one of several passages. The passages varied in length from about 800 to 3,000 words. Intentional learning (items included in the objectives) and incidental learning (all other items) were assessed. Both types of objectives yielded greater intentional learning than a passage without objectives, and specific objectives were more effective than general objectives. Intentional learning of any particular objective decreased as the number of passage sentences relevant to that objective increased. Study time increased as passage length and number of objectives increased.

9P, 4R

Comments

Here is some positive support for the use of instructional objectives.

Entry Number 79

Key Words

paragraphs, structure
EGood And Bad Structure In Simple Paragraphs: Effects
On Apparent Theme, Reading Time, And Recall

KIERAS, D.E.

Journal of Verbal Learning and Verbal Behaviour, 1978,
17, 13-28.

Description

Good paragraph structure is said to involve two main things: 1) a statement of the theme in the first sentence, and 2) a coherent development of that theme by sentences which connect with one another in a sequence. Three experiments are described in which subjects read simple paragraphs which conformed to or violated these two conventions. Paragraphs which violated the conventions led to longer reading time, lower recall of content and less likelihood of ascertaining the theme. It was concluded that the conventions serve to lessen the load in short-term memory, and thus lead to better integration.

16P, 20R

Comments

The article discusses theoretical concepts in some depth; these sections may not be of interest to writers looking for practical guidelines. However, the conclusions do lend support to an established method of paragraph structuring.

Entry Number 80

Key Words

instructional design

A

Review Article: Designing Instructional Text

KINROSE, R.

Instructional Science, 1979, 8, 275-289.

Description

This is a review of "Designing Instructional Text", (Hartley, 1978) (see entry # 59). The book is criticized on several points, the main criticism being that the stated purpose of the book is misleading. Rather than seeking to fulfill the goal of providing benefits to the user of instructional text, Hartley is said to approach the problems of design from a cost-benefit position. That is, where his simplified design is found experimentally to be as effective as a traditional, more expensive design, his design is said to be better. The reviewer stresses that great caution must be taken when making such wide generalizations from specific studies. The fact that Hartley does this, and proposes a design program from it, is seen as really trying to benefit the producer instead of the user. It is recognized that Hartley sees this problem, but that he does not put sufficient qualifications on the application of his findings and his program of instructional design.

15P, 4R

Comments

It would be good to read this if you are using Hartley's book. Also, Hartley replies to this review in an article which immediately follows this paper in the same journal.

Entry Number 81

Key Words

models, cognition
readability, theory
M

Reading Comprehension And Readability In Educational
Practice And Psychological Theory

KINTSCH, W. and Vipond, D. in Nilsson, L.G. (Ed.)
Perspectives On Memory Research, Hillsdale, N.J.:
Lawrence Erlbaum Associates, Publishers, 1979.

Description

The authors advocate the development of an educational technology based on principles of cognitive psychology. Readability formulas deal only with the symptoms of poor writing, but readability goes beyond a tally of syllables, words and sentences. What is needed is a theory of readability which deals with the deeper characteristics of the text and reader that determine reading ease. Such a model is presented in this paper. The authors suggest that the readability score be replaced by a readability profile that indicates how a particular text would be responded to by different readers.

36P, 39R

Comments

This is an academic discussion. It points out some shortcomings of readability formulas, and offers a more comprehensive model of readability. The model is not of practical use as it is presented, however.

Entry Number 82

Key Words

cartoons, illustrations

A

The Cartoon As Technical Communicator

KITTENDORF, D.K.

Proceedings of the 27th International Technical
Communication Conference, 1979, 1, G-11-13.

Description

Cartoons can often provide more effective communication than can prose. Cartoons attract attention and help create in the reader a positive disposition towards the content. In this way, messages which the reader may be antagonistic about or which he may otherwise miss are presented in a more pleasing and memorable way than is possible with text. Other benefits of cartoons are discussed.

3P, OR

Comments

This is a good discussion of the pros of using cartoons. It gives lots of ideas about where to use cartoons, but few examples. It is not a guide to writing effective cartoons.

Entry Number 83

Key Words

readability
readability formulas
A, G

Assessing Readability

KLARE, G.R.

Reading Research Quarterly, 1974-1975, 10, 62-102.

Description

Formulas and other devices for predicting readability are reviewed. Included are: 1) recalculations and revisions of formulas existing prior to 1960, 2) new formulas for both general and special use, 3) application aids for manual and machine use, and 4) formulas for use with foreign languages. Finally, suggestions are given for how to choose a formula to suit specific needs.

41P, 131R

Comments

This article has more breadth than depth; it gives a comprehensive account of formulas developed up until about 1974, then gives complete references for where to get more detailed information. In the application aids section, articles which explain both manual and computer adaptations of the formulas are referenced.

Entry Number 84

Key Words

readability
readability formulas
A, B, R

The Measurement Of Readability

KLARE, G.R.

Ames, Iowa: Iowa State University Press, 1963.

Description

This book is a critical analysis of research in readability, where readability is defined as ease of understanding or comprehension due to the style of writing. There is an extensive review of readability formulas and the principles behind them. Methods and procedures for using these principles and formulas are pointed out. The problems of sampling adequacy, analyst reliability and validity are discussed. An exhaustive annotated bibliography with 482 entries is given, covering the work in readability up until about 1960.

328P, 482R

Comments

A very thorough account of the concept of readability and readability formulas, with most emphasis placed on research developments. For those who want to study readability formulas in some detail this will be helpful. However, most of the information is not of immediate practical use.

Entry Number 85

Key Words

readability
technical writing
A

Readable Technical Writing: Some Observations

KLARE, G.R.

Technical Communication, 1977, 2nd quarter, 1-5.

Description

The author defines readable writing as that which can be read quickly, understood clearly and accepted readily. This article addresses two problems: how to assess the readability of a passage and how to produce readable writing. The benefits and drawbacks of readability formulas are discussed under prediction of readable writing. Numerous elements of writing style are discussed under production of readable writing.

4P, OR

Comments

User characteristics are not really addressed here. Assuring readability is seen as making a match between the user's reading level and the readability score.

Entry Number 86

Key Words

readability
 reader characteristics
 A, T

Know Your Reader

KLARE, G.R. and Buck, B.
 New York: Hermitage House, 1954.

Description

This is an enjoyable, if somewhat dated, account of the origin and development of readability formulas and the growing emphasis placed on "writing for the reader". Readability formulas are described and their uses and abuses discussed. The authors maintain that writing must precede rating readability with formulas; i.e. the formulas are for analysis, not synthesis. Above all, the writer must determine who his audience is before beginning to write. Important variables to be considered in assessing reader characteristics are pointed out. The overall tone of the book is that writing is an art, and that although steps can be taken to systematically improve one's writing, writing itself cannot be reduced to a science.

192P, 194R

Comments

Thirty years lie between this book and present-day research, but it can help one get a basic idea of the principles on which readability formulas are based.

Entry Number 87

Key Words

readability, standards
manuals
T

The New Readability Requirements For Military
Technical Manuals

KNIFFEN, J.D.

Technical Communication, 1979, 3rd quarter, 16-19.

Description

This paper discusses how the U.S. military have imposed readability requirements on the production of manuals for use by the military services, prompted by the discovery that a great many existing manuals were beyond the level of comprehension of servicemen. In the requirements, readability is assessed using the recalculated Flesch formula, and acceptable grade levels are specified. Ways in which suppliers of manuals may be affected by the new requirements are discussed.

4P, 13R

Comments

This is one of the few articles which looks (albeit briefly) at the problems of the manual supplier.

Entry Number 88

Key Words

readability
AReadability Techniques For Authors And Editors

LANER, F.J.

Journal of Technical Writing and Communication, 1976,
6(3), 203-213.

Description

Authors and editors are encouraged to study and apply the techniques found through research for improving readability. Various research areas are discussed briefly, and references are given for more in-depth treatments of these areas.

11P, 7R

Comments

This is not a particularly enlightening article, and tends to be scattered in presentation.

Entry Number 89

Key Words

instruction
novice, training
modules
E, T

Learning to Use a Text Processing System: Evidence
from "Thinking Aloud" Protocols

LEWIS, C. & Mack, R.
Proceedings of Human Factors in Computer Systems.
Gaithersburg, Maryland, 1982, 387-392.

Description

Six office workers spent four half days using a self-instruction manual that accompanied a commercially available text-processing system. They "thought aloud" as they worked. The researchers analyzed these records and the actual responses and arrived at a number of generalizations. Self-study from manuals has some difficulties which manual designers will not be able to overcome. It is not possible to completely control what the users do. They make mistakes in following instructions and are then unable to recover. They also generalize inappropriately from previous experiences in thinking about the system and controlling what users think is as difficult as controlling what they do. Finally, users lose sight of what they are trying to do and blindly attempt to follow the instructions. The authors conclude that unaided structured self-study is not an effective training method.

10P, 3R

Comments

This article is a rich source of examples of the difficulties which novice users have in using a "friendly" text-processing system and of the difficulties of using a self-instruction manual.

Entry Number 90

Key Words

advance organizers

R

A Meta-Analysis Of The Effects Of Advance Organizers
On Learning And Retention

LUITEN, J., Ames, W. and Ackerson, G.
American Education Research Journal, 1980, 17(2),
211-218.

Description

The results of 135 studies conducted on advance organizers from 1960-1979 are pooled and analyzed. The technique of "effect size" (a standardized measure of treatment effect) is used to determine the average effect of advance organizers on learning and retention. Separate analyses are shown for grade level, subject area, and ability level. It is concluded that advance organizers in general show a small facilitative effect for all the grade levels, subject areas and ability levels represented.

9P, 10R

Comments

This is interesting in that it indicates an overall positive (though small) effect of advance organizers across a wide variety of testing situations. However, this approach says nothing about how the effectiveness of advance organizers differs according to their structure and the circumstances of their use. This seems to be where more detailed research is needed.

Entry Number 91

Key Words

graphics, illustrations
 diagrams, typography
 R, G

Graphics In Texts

MACDONALD-ROSS, M. In Shulman, L. (Ed)
 Review of Research in Education, 1978, 5, 49-85.

Abstract

This review of various types of graphic devices in text uses both research and the experience of graphic communicators to provide guidelines. Only research results which are of practical value or form a basis for other researchers to build on are included. The topics discussed include a review of the visual perception literature to determine what types of information from this field, and from the field of cognition might be of general use. Use of tables and charts, diagrams, algorithms, and other graphic devices are considered. In addition, a brief review of typography guidelines is included. At all levels, an effort is made to indicate existing guidelines, and to point the way to productive research strategies. Finally, the author feels that a skilled intermediary or professional communicator is needed to bridge the gap between researcher and practitioner by interpreting the practical implications of general principles in particular applications.

37P, 139R

Comments

This review will be of great interest to practitioners and researchers alike. It is the only recent review to attempt to gather information on graphics. It presents guidelines, but also says a great deal about the directions in which further research is needed.

Entry Number 92

Key Words

charts, graphs
numbers, tables
R

How Numbers Are Shown

MACDONALD-ROSS, M.

Audio-Visual Communication Review, 1977, 25(4),
359-407.

Description

This is a review of research on the presentation of quantitative data within text. The author has attempted to distinguish reliable results from useless ones. There is an initial section devoted to defining and illustrating the various formats for presenting quantitative data which are discussed in the paper. The first part of the review looks at methods for presenting trends, comparisons and general information. Under abstract formats, (those which require words to explain what they represent), are included tables, graphs, bar charts, pie charts, circle graphs and maps. Under pictorial charts (those which use symbols to show what they represent) the discussion centers around the "isotype" system. Part two of the review looks at methods for presenting exact numbers. The main formats discussed are tables and nomograms (computation charts). General conclusions are given in a summary.

47P, 118R

Comments

This is probably the most complete review of this topic. Specific guidelines are not given in the paper, but useful suggestions can be obtained from the summary.

Entry Number 93

Key Words

organization, sequencing
instructional design
E

On The Sequencing Of Instructional Content

MAGER, R.F.

Psychological Reports, 1961, 9, 405-413.

Description

Traditionally, the order or sequencing of instructional content is decided by an instructor. In this study six subjects were allowed to control the learning situation. Subjects were each given the services of an instructor for as many sessions as they desired, each session lasting as long as they desired. The instructors were present only to answer subjects' questions about electronics. It was found that the content, sequence and emphasis chosen by the students differed considerably from that of most introductory electronics curricula.

9P, 2R

Comments

By allowing students to ask about what they wanted to know, the author was able to assess what knowledge they already possessed and what sequence of receiving other information was most meaningful for them. This method could be useful in assessing user groups so that instructional materials could be tailored for their particular needs.

Entry Number 94

Key Words

instructional objectives
TPreparing Instructional Objectives

MAGER, R.F.

Belmont, Calif.: Fearon Publishers Inc., 1972.

Description

Instructional objectives are statements which describe a desired instructional outcome, i.e. what a student must be able to do, under what conditions, and to what degree of mastery after receiving instruction. This book is a practical guide to developing behaviour-based instructional objectives. Through a series of short exercises, the reader is shown how to define objectives in performance terms, avoiding abstractions. How to specify a criterion of acceptable performance in terms of speed, accuracy and quality is described. Common pitfalls to beware of are discussed.

136P, OR

Comments

The use of instructional objectives can help clarify for the user what he ought to be able to do after working through a manual. Instructional objectives may also help the writer see how to better organize information for the user. This book is both enjoyable and informative.

Entry Number 95

Key Words

pictorial instructions
A, EParagraphs Of Pictographs: The Use Of Non-Verbal
Instructions For Equipment

MARCEL, T. and Barnard, P. in Kolers, P., Wrolstad, M.
and Bouma, H. (Eds.)
Processing of Visible Language (I). New York: Plenum
Press, 1979.

Description

The use of pictorial instructions for operating equipment has not received much research attention. This paper deals with the problem of sequencing pictures so that they are logically and meaningfully linked and thus provide a cohesive instructional message. Also, behavioural characteristics which affect the way people use pictorial instructions are looked at. Subjects were shown sequences of pictures and were required to either write a detailed description of the actions illustrated or to actually operate the equipment as illustrated. Eight pictographic sequences were designed so that they differed in how the equipment was represented and how the pictures were organized and sequenced. These variables were found to influence how well subjects comprehended the instructions. It was also found that subjects processed the instructions differently depending on whether they were describing them verbally or using them to operate the equipment.

17P, 29R

Comments

The results of this particular experiment may not be generalizable to other situations, but the questions which are raised are certainly worth investigating in further research.

Entry Number 96

Key Words

instructional design
models
M

The Instructional Message: A Theoretical Perspective

MARSH, P.O.

Educational Communication and Technology Journal, 1979,
27(4), 303-318.

Description

A model for instructional message design based on mathematical communication theory, cognitive and social psychology, and classical rhetoric is presented in this paper. The model prescribes a message design which adapts information relevant to the learner's needs to the learner's cognitive capacities, while satisfying the requirements of the medium. The model was used to design college-level instruction by radio, and was found to be more effective than regular classroom learning. The author sets out several hypotheses based on the model which he plans to test through empirical research.

16P, 22R

Comments

This is a theoretical paper describing a rather complex model, and as such it tends to be difficult reading. The author believes that once his model is validated by experimentation, it can be computerized so that in the future highly individualized messages can be created almost instantly. For the present, however, the model is not likely to be of much practical use.

Entry Number 97

Key Words

language, style
transitional devices
T

Transitional Devices For The Writer

MARSHEK, K.M.

IEEE Transactions on Professional Communication, 1975,
PC-18(4), 320-322.

Description

Transitional devices are defined as logical or mechanical connections between or among ideas or topics. They may be words, phrases, clauses, sentences or paragraphs, but are seen as being of most importance between sentences and between paragraphs. Transitional devices give order and motion to ideas and are essential to clear writing. Six kinds of transitional devices are described and illustrated, and ten guidelines for their proper use are given.

3P, 2R

Comments

This is a concise and fairly complete account of transitional devices, and could be quite useful as a reference as it contains many examples.

Entry Number 98

Key Words

documentation
evaluation, manuals
G

Good Software Documentation Depends On Proper Audience
Analysis

MARTIN, J.M.
Infosystems, 1981, Dec., 71-72.

Description

Software documentation must be developed with the particular users' needs in mind. Management is responsible for ensuring that good documentation accompanies new equipment by making these specific user needs known to the software vendor. Management can also assess documentation before purchase by looking for certain indicators, which are very briefly outlined in this paper.

2P, OR

Comments

This can point you in the right direction for giving manuals a quick "once-over", but the proposed method of assessing manuals is not reliable since it depends upon the evaluator's subjective interpretation. Ideally, a manual should be tested on those for whom it is intended, since they are the ones who will ultimately demonstrate its degree of usability.

Entry Number 99

Key Words

models, novices
advance organizers
elaboration
R

The Psychology Of How Novices Learn Computer
Programming

MAYER, R. E.
Computing Surveys, 13, 1981, 121-141.

Description

This review focuses upon the current state of knowledge of how to increase the novice's understanding of computers and programming. The literature on advance organizers is reviewed, with particular emphasis upon providing concrete models to aid the users. He concludes that these models aid novices in transfer and retention of concepts, although retention of details is sometimes higher without the model. A second technique, elaboration, is also discussed. Elaboration means putting material into the users own words. It is difficult to design activities which will consistently produce the desired restatement. However, transfer is improved under certain conditions.

21P, 68R

Comments

This is an excellent review of the current activity in the important area of providing conceptual models for users of computer systems. It not only provides an excellent summary of research, but reviews the theoretical basis for assimilating the results.

Entry Number 100

Key Words

advance organizers
elaboration, novices
E

Elaboration Techniques That Increase The Meaningfulness
Of Technical Text

MAYER, R.E.

Journal of Educational Psychology, 1980, 72(6),
770-784.

Description

Five experiments are described in which naive users read a text on computer programming which involved one of the following techniques designed to enhance learning: advance organizer, model elaboration, comparative elaboration. The advance organizer technique involved presenting a model of the computer before the text. Model elaboration involved having subjects answer questions after each page of text which required them to relate the text to the model of the computer. Comparative elaboration involved having subjects compare and contrast the commands of the computer language as they read about them. Subjects were tested on their ability to solve problems and to recall information from the text. It was found that, compared with the control subjects, subjects who used the learning techniques recalled more conceptual material and were better able to apply what they had learned in a novel way.

14P, 24R

Comments

These results were found for low ability subjects who were learning unfamiliar material, and as such may be useful to those who are preparing manuals for naive users.

Entry Number 101

Key Words

advance organizers
adjunct aids
A, M

Can Advance Organizers Influence Meaningful Learning?

MAYER, R.E.

Review of Educational Research, 1979, 49(2), 371-383.

Description

Mayer challenges the conclusion of Barnes & Clawson (1975), that advance organizers do not facilitate learning. He begins by discussing three weaknesses in the review. He then describes three theories which are assumed to underlie advance organizers, and tests several predictions of one theory. He concludes that when advance organizers are used properly and assessed adequately they do have an effect on learning. An attempt is made to define the essential characteristics of advance organizers.

13P, 22R

Comments

Mayer is a leading researcher in the area of teaching novices about computers. This is an important paper which links the well-known need to provide a conceptual model to novice computer users with the technique of using advance organizers.

Entry Number 102

Key Words

models, novices
transactions, concretes
A, R

A Psychology Of Learning BASIC

MAYER, R. E.

Communications of the ACM, 22(11), 1979, 589-593.

Description

Mayer identifies different levels at which a language such as BASIC might be known. In particular, he is interested in a level, directly above the machine level, which he calls a transaction level. A transaction involves the idea of an operation (such as MOVE, FIND) being applied to an object (such as number, pointer) at a location (such as memory address or keyboard). This can be contrasted with a statement level at which programming is usually taught (for example, LET or PRINT). Mayer suggests that novices should be explicitly taught the basic transactions involved in BASIC including a concrete and familiar context for understanding the operations, objects and locations. The author briefly summarizes some of his research supporting these recommendations.

5P, 9R

Comments

This article is very useful as a "how-to" reference. By using BASIC as an example, the method of analysis needed to provide the kind of conceptual model which faithfully reflects the language and provides concrete references for the novice is illustrated.

Entry Number 103

Key Words

advance organizers
control of order, learning
novices, programming

Some Conditions Of Meaningful Learning For Computer
Programming: Advance Organizers and Subject Control
Of Frame Order

MAYER, R. E.

Journal of Educational Psychology, 68(2), 1976, 143-
150.

Description

One hundred and sixty nonprogrammers learned a computer programming language and took a multileveled transfer test. Subjects who were given pretraining with an advance organizer in the form of a concrete model of the computer before learning performed better on novel transfer but worse on near transfer relative to no-pretraining subjects including subjects who were given posttraining with the same model after learning. A similar pattern of transfer was noted for subjects who controlled the order of presentation of frames by selecting from a table of contents compared to different random orders controlled by the experimenter.

8P, 12R

Comments

An early example of Mayer's research on methods of teaching programming which lead to transfer. This is his only experiment in which order of presentation of the material is controlled either by the learner or the researcher.

Entry Number 104

Key Words

advance organizers
models, novices
E

Different Problem-Solving Competencies Established
In Learning Computer Programming With And Without
Meaningful Models

MAYER, R.E.

Journal of Educational Psychology, 1975, 67(6),
725-734.

Description

This paper describes a set of experiments designed to test the effectiveness of teaching novices a computer programming language using a model of the computer based on concepts familiar to novices. It was found that such a model seemed to operate as an "advance organizer", providing a readily understood superstructure to which the unfamiliar information about programming could be related. Subjects who used the model were found to be better at interpreting programs than were "non-model" subjects, and non-model subjects were better at generating programs. The model was most effective for subjects low in mathematical ability.

10P, 13R

Comments

The ideas presented here have relevance to manual production, especially for those situations where the prospective users have little background experience and could benefit from a more familiar presentation of difficult concepts.

Entry Number 105

Key Words

advance organizers
 learning, novices
 programming, models
 E

Different Recall Protocols For Technical Texts Due To
 Advance Organizers

MAYER, R. E. & Bromage, B. K.
 Journal of Educational Psychology, 72(2), 1980, 209-225.

Description

In two experiments, 108 subjects read a text concerning a new computer programming language, with an advance organizer given either before or after reading. On a subsequent recall test, there were different patterns of performance. The before group scored higher on recall of conceptual idea units, produced more appropriate intrusions, and made more novel inferences; the after group scored higher on recall of technical idea units and produced more inappropriate intrusions, connectives, and vague summaries. Results support the idea that the locus of the effect was at encoding rather than retrieval and favor an assimilation encoding theory.

17P, 33R

Comments

This article is an excellent introduction to Mayer's work in the area of teaching computer programming through the use of advance organizers. The original work of Ausubel is briefly reviewed and Mayer's adaptation of the idea is described. The theoretical foundations are clearly presented and the method of designing the advance organizers and the test material is given.

Entry Number 106

Key Words

user models, transaction
calculators, learning
experts, novices
A

Psychology Of Calculator Languages: A Framework For
Describing Differences In Users' Knowledge

MAYER, R. E. & Bayman, P.
Communications of the ACM, 24(8), 1981, 511-520.

Description

This paper presents a framework for describing users' knowledge of how a simple four-function calculator operates. Differences among novices and experts in their conceptions of "what goes on inside the calculator" for various sequences of button presses are summarized. Individual differences include different views on when an expression is evaluated, different procedures for evaluating a chain of arithmetic, and different rules for evaluating unusual sequences of key presses.

10P, 16R

Comments

It is clear from this paper that Mayer is planning to apply his work on advance organizers, previously restricted to teaching novices programming languages, to the teaching of calculator use. Calculators are the first experience with computers that most users have and inappropriate models are found at this level.

Entry Number 107

Key Words

text
learning
RLearning From Text

McCONKIE, G. W. In Shulman, I. (Ed)
Review of Research in Education, 1978, 5, 3-48.

Description

This review article has a discussion of the nature of text, and discusses the importance of text analysis to research in the area. Research investigating the sequencing and organization of text is clearly reviewed, and methodological techniques for providing an unambiguous task to the learner are described. Here classical areas such as use of questions, instructions, rewards, and level of processing are discussed under the topics of modifying expectations concerning evaluation, concerning weights of different outcomes, concerning results of the evaluation, modifying depth of processing. There are also short sections on retrieval processes, individual differences and other environmental influences on learning. The author feels there is a need for a new discipline called cognitive psychology, relating education, psychology, linguistics and computer science in the study of language processing and learning.

46P, 209R

Comments

This review is not the type which will interest technical writers who are searching for guidelines. However, it will be of interest to researchers for the interesting and different way in which the research is organized and presented. Psychological literature is related to various questions which might be asked about how text is learned.

Entry Number 108

Key Words

graphs
ELabelling Graphs For Improved Reading Speed

MILROY, R. and Poulton, E.C.
IEEE Transactions on Professional Communication, 1979,
PC-22(1), 30-33.

Description

Fifty-four subjects answered questions concerning graphs which were labelled in 3 different ways: 1) direct labelling of functions, 2) a key inserted below the functions, and 3) a key inserted in the figure caption. Subjects were able to use the graphs with direct labelling more quickly than the other two types of labelling. Accuracy of use did not differ across the three types of labelling. It is suggested that direct labelling places less load on short-term memory.
4P, 4R

Comments

This bears directly on the design of labelled illustrations in manuals.

Entry Number 109

Key Words

learning, questions
EEffects Of Questions On Prose Unitization

MOESER, S.D.

Journal of Experimental Psychology, Human Learning and Memory, 1978, 4(4), 290-303.

Description

Detrimental and facilitative effects of questions inserted in prose were assessed in four experiments. It was found that when subjects read a text with inserted questions and were encouraged to concentrate on each individual sentence they were worse at recalling both questioned and unquestioned material on a post test than were subjects who read a text without any questions. Subjects who were encouraged to concentrate on how the sentences formed a unified story while reading a text with inserted questions performed better than either of the abovementioned groups. When questions were worded the same in both the text and the post test, subjects were able to recall facts they were questioned about better than those they were not questioned about. No such effect was found, however, when the questions were worded differently.

14P, 19R

Comments

If a manual is to include questions for the user, they must be carefully placed in order to help, rather than hinder, learning. This article looks at some of the factors which determine the effect questions will have on learning.

Entry Number 110

Key Words

feedback, naive user
performance
A, G

How To Feed Back Performance Results To Trainees

MOSEL, J.N. in Fleishman, E.A. (Ed.)
Studies in Personnel and Industrial Psychology.
Homewood, Ill.: The Dorsey Press, 1967.

Description

The importance of giving trainees feedback on their performance is stressed. It is stated that learning increases in both rate and level as knowledge of performance increases. Feedback gives the trainee information on what he needs to learn and it motivates him to keep on learning. However, the feedback information must have certain qualities. It must be unique, that is, it must give the trainee information which he does not already possess about his performance. It must be given as soon as possible after the trainee's own response so that he can compare the two. Also, it must give him specific information about how he has performed so that he can discern the source of his errors. The manner in which feedback should be given so that it does not threaten or offend the trainee, but rather helps him achieve goals in a way which is meaningful to him, is discussed.

9P, OR

Comments

Often, users learn inefficient ways of operating equipment and maintain these behaviours because they don't know any better. Constant feedback throughout an instructional manual could help prevent this.

Entry Number 111

Key Words

documentation, user needs
A, G

Documentation For Computer Users

NEWMAN, N. and Lang, T.
Software - Practice and Experience, 1976, 6, 321-326.

Abstract

The importance of good user documentation is stressed. The essential elements of well-designed documentation are outlined, with particular emphasis placed on addressing the particular user's needs. Aspects of production and distribution are discussed.
6P, OR

Comments

This is a fairly undetailed treatment of the subject, but serves to bring together general areas which documentation writers should consider.

Entry Number 112

Key Words

errors, feedback
system design
A

Steps Toward A Cognitive Engineering: Design Rules
Based On Analysis Of Human Error

NORMAN, D. A.

Proceedings of Human Factors in Computer Systems,
Gaithersburg, Maryland, 1982, 378-382.

Abstract

This paper shows how the analysis of human error can serve as a tool for development of principles of system design, both to minimize the occurrence of error and to minimize its effects. The author distinguishes between "mistakes" - errors in understanding which lead to inappropriate, intended actions; and "slips" - errors in carrying out the intentions. The article deals primarily with classes of slips and procedures for minimizing them.

5P, 10R

Comments

This article makes a distinction between slips and mistakes which may prove useful in designing documentation. Mistakes, errors due to inappropriate models of what a system does, would appear to be the type of problem that Mayer and others are attempting to avoid by providing appropriate conceptual models to novices. Slips, made by a person who knows what to do, but fails to execute properly, probably cannot be reduced through documentation.

Entry Number 113

Key Words

documentation, evaluation
GEvaluate User Documentation Before You Buy The Software

PAKIN, S.

IEEE Transactions on Professional Communication, 1981,
PC-24(2), 75-78.

Abstract

The documentation which accompanies software packages plays a crucial part in the ultimate cost of implementing the system. Poor documentation can discourage users from learning the system and can mislead them into making costly errors. User documentation must be evaluated from the user's point of view for its communicative and technical quality and this evaluation must take place before purchase. By communicative quality is meant how well it can transmit information to the user in an easy, enjoyable way. In this section such topics as indexing, troubleshooting guides, illustrations, legibility and scanability are discussed. Technical quality refers to the accuracy, completeness and clarity of presentation of the technical information. Criteria for assessing documentation in terms of these aspects of communicative and technical quality are given.

4P, OR

Comments

These evaluation criteria could serve as basic guidelines in the initial production of manuals.

Entry Number 114

Key Words

documentation, modules
A, G

Modularity: A Phased Approach To Documentation

PAKIN, S.

Association for Computing Machinery, Special Interest
Group for Systems Documentation, (ACM SIGDOC),
Asterisk, 1981, 7(4), 27-28.

Abstract

The author suggests that software documentation be developed in phases to accompany computer systems as they are installed in phases. This modular approach involves writing units of information designed to teach specific user groups only what they need to know. Since modules are independent of each other, they can be written at different times by different writers. Also editing, reviewing, testing, and producing these smaller units is less cumbersome and time-consuming than carrying out these operations on a lengthy all-in-one manual. Modular documentation requires careful management in order to ensure that user needs are correctly identified, all necessary information is included in each module, standards of writing and production are met, and the modules are ready on time.

2P, OR

Comments

This offers general guidelines for developing a modular documentation project. The actual structure and content of the modules is not discussed.

Entry Number 115

Key Words

illustrations

A

Pictures And The Real Thing

PERKINS, D.N. in Kolers, P., Wrolstad, M.,
and Bouma, H. (Eds.)
Processing of Visible Language (II), New York, Plenum
Press, 1980.

Abstract

It has been argued that realistic pictures are immediately "readable" since they resemble what they represent. This article discusses research findings which show that people must learn how to read even realistic pictures. In any case, the author feels that a picture's "informativeness" is what ultimately determines how well people will understand it. Three rules (with examples) for increasing the informativeness of pictures are given.

20P, 54R

Comments

The guidelines are rather general, and not of immediate applicability, but there are some ideas in here which might be useful.

Entry Number 116

Key Words

technical writers

A

Tech Writers Talk

PETERSEN, Perry
Datamation, 1981, 81-84.

Abstract

Technical writing and data processing managers were asked to talk about what problems exist in the field and where tech writing seems to be headed. Topics include qualifications of writers, salaries, input from users and how writers should be trained. An amusing "glossary of computerese" is presented.

4P, OR

Comments

This gives a "feel" for the situation of tech writers today, and where at least some of them think problems exist.

Entry Number 117

Key Words

graphs
EHow Accurately Are Different Kinds Of Graphs Read?

PETERSON, L. and Schramm, W.

Audio-Visual Communication Review, 1954, 178-189.

Abstract

Eight forms of graphs (circle, disc, single bar, multiple bar, multiple cylinder, multiple square columns, multiple area columns and partial cosmograph) were compared. Eighty-six airforce personnel were tested for how accurately they used the graphs. The circle graph (pie chart) was found to be used more accurately than any other kind. The effects of altering various components of graphs are looked at. A discussion of the generalizability of these findings is given.

12P, 10R

Comments

These graphs were designed to represent parts of a whole (e.g. the distribution of a budget). The results do not bear on graphs of mathematical functions. It may be that people have become more sophisticated in interpreting different forms of graphs, rendering these results invalid.

Entry Number 118

Key Words

organization
sequencing
TA Categorization Scheme For Principles Of Sequencing
Content

POSNER, G. and Strike, K.
Review of Educational Research, 1976, 46(4), 665-690.

Abstract

This paper describes a system for sequencing the content of instructional materials according to the characteristics of the subject matter. Five basic categories, each with subcategories are described. The first type of sequencing is called "world-related", and is based on the relationship between the content and the real world. For example, history should be taught according to the actual sequence of events in time. The second category is called "concept-related", and is based on teaching general concepts before specific ones. "Inquiry-related" sequencing reflects the nature of the logical process of discovering knowledge. "Learning-related" sequencing calls for teaching primary component skills before teaching a more complex skill. "Utilization-related" sequencing involves teaching how to deal with situations as they are most likely to be encountered on the job or in social/personal situations. There are several examples given for all the categories to help clarify what sort of situations each type applies to.

26P, 84R

Comments

This might be of help as a general guide to the meaningful sequential organization of information in manuals. Perhaps combining two or more types of sequencing could be considered.

Entry Number 119

Key Words

typography
AHow Efficient Is Print?

POULTON, E.C. in Davies, I. & Hartley, J. (Eds.)
Contributions to an Educational Technology, London:
Butterworth & Co. (Publishers) Ltd., 1972.

Abstract

Styles of type and layout of printed material must be both attractive and efficient at communicating information. This article discusses the findings of research on various aspects of print. Typeface and typesize, the use of capitals and lower case letters, and other factors affecting reading efficiency are looked at.

11P, OR

Comments

All of this can be found in greater detail in Hartley (1978) (see entry #59).

Entry Number 120

Key Words

readability
readability formulas
A

(FORUM) Readability Formulas: Used Or Abused?

POWELL, K.; Barry, J.; Redish, J.; Frase, L.; Bruce, B., Rubin, A. & Starr, K.; Plung, D.
IEEE Transactions on Professional Communication, 1981, PC-24(1), 43-54.

Abstract

Eight authors present their views on the value of readability formulas, and how they should be used. Powell discusses the misuse of formulas and stresses that readability is not necessarily related to quality of writing. Barry describes how she has devised computer programs for the major readability formulas and discusses how they work. Redish looks at eight limitations of readability formulas. Frase describes a program which he has devised to provide detailed editorial comments about text. Bruce et al., and Plung both look in depth at various shortcomings of readability formulas.

12P, 47R

Comments

This is an excellent source of information on how prominent researchers currently regard readability formulas.

Entry Number 121

Key Words

reading styles

R

Styles And Strategies In Silent Reading

PUGH, A.K. in Kolers, P., Wrolstad, M.
and Bouma, H. (Eds.)
Processing of Visible Language (I), New York: Plenum
Press, 1979.

Abstract

Reading research which has concentrated on measuring eye movements has not provided us with usable models of normal reading behaviour. Research is gradually turning to other factors associated with reading, such as reading style, purpose, and the use of strategy in reading. This paper describes three studies which employed a specially devised apparatus for looking at styles of reading and their strategic use in locating information in text. It is concluded that the method needs refinement, but that it can be helpful in developing a more useful model of reading and for providing practical suggestions for improving reading skills.

13P, 40R

Comments

This won't be of practical use to writers but what it says about search strategies may have implications for the layout and cueing of instructional text.

Entry Number 122

Key Words

language
technical writing
A

Technical Writing, Stylistics, And TG Grammar

RAMSEY, R.D.

Journal of Technical Writing and Communication, 1977,
7(4), 333-345.

Abstract

Technical writing is often criticized for being uncreative, impersonal and boring. The author argues that there is no logical reason why technical writers should write like this, and that even empirical facts can be communicated in fresh, interesting ways. He advocates the use of a set of rules which enable one to generate grammatical sentences and to express the same thought in various different sentence patterns. Transformational generative (TG) grammar is defined and the principles involved are explained. It is suggested that technical writers and students learn and apply the principles of TG grammar to create more personal, effective communication.

13P, 19R

Comments

This article will not give you any usable rules of TG grammar. It merely suggests that a TG grammar approach to technical writing be compiled into a textbook and taught to writers.

Entry Number 123

Key Words

illustrations, learning
EImagery Instructions And Drawings In Learning Prose

RASCO, R., Tennyson, R. and Boutwell, R.
Journal of Educational Psychology, 1975, 67(2),
188-192.

Abstract

Three populations of students (college, high school, grades 4 and 5) were tested for verbal learning of a passage presented with or without instructions to form images and with or without drawings illustrating the main concepts. College students performed better when they were given imagery instructions or drawings or both than did those without either. There was no effect for high school students. Fourth and fifth-graders were instructed to draw images rather than form mental images. This group benefited from drawing images and having drawings presented to them. Implications for instructional design are discussed.

5P, 17R

Comments

Here is more evidence for the effectiveness of combining pictures with text to increase learning and memory for instructional material. This may not be important in producing quick reference manuals, but could make a substantial difference in the presentation of material which must be learned and remembered.

Entry Number 124

Key Words

legibility
RLegibility Studies: Their Relevance To Present Day
Documentation Methods

REYNOLDS, Linda

Journal of Documentation, 1979, 35(4), 307-340.

Abstract

This paper summarizes many of the research findings on the legibility of printed materials. Topics covered are methods of legibility research, typography and layout, paper and ink, special sections (bibliographies, indexes, etc.) and tables. Problems in producing legible microforms, computer printouts and CRT displays are also discussed. The author suggests that much research is needed to improve the design of these new media.

34P, 54R

Comments

Some of this information is more complete in Hartley (1978) (see entry #59) but a good deal of it is new. There are no specific guidelines offered. There are sections on the legibility of microforms, computer printouts and cathode ray tube displays.

Entry Number 125

Key Words

adjunct aids
questions
R

Adjunct Postquestions In Text: A Critical Review of
Methods And Processes

RICKARDS, J. P.

Review of Educational Research, 49(2), 1979, 181-196.

Abstract

This article reviews the literature specific to the use of adjunct postquestions. The original work in this area was highly tied to neobehaviourism and focused on reinforcement of studying strategies and discrimination of what to study in future material. More recent work has focused on the type of cognition involved, comparing the use of meaningful or rote questions. Methods for assessing the effects of postquestions are reviewed and suggestions for future research are provided.

16P, 37R

Comments

This review concentrates on methodology in a very limited area of the adjunct question literature. It is less appropriate as a general overview than the Andre (1979) article.

Entry Number 126

Key Words

psycholinguistics
technical writing
A

Improving The Understandability Of Technical Text:
Some Practical Implications Of Recent Psycholinguistic
Research

ROBBINS, J.C.

Proceedings of the 27th International Technical
Communication Conference, 1980, 2, R-241-245.

Abstract

Psycholinguistic researchers have discovered certain principles of language comprehension and retention which can be applied in preparing intelligible text. Technical writers should use this information just as an engineer would use scientific principles to construct a bridge. The author briefly discusses some of the research findings including the use of actives and passives, clause order, temporal and causal order, deletion of terms and indeterminate terms, and in each case sets forth a general principle to be followed in order to maximize intelligibility of the text. Contradictions between principles is discussed. Finally, a short set of guidelines on the use of questions in text is presented. Through psycholinguistic research, a scientific base is being developed for technical writing. The technical writer is encouraged to seek out this information and apply it in order to increase comprehension of his communications.

5P, 6R

Comments

Although technical writers are encouraged to find out what psycholinguistic research has to offer them, these scanty references don't offer much help.

Entry Number 127

Key Words

documentation project
TMorale And Process Of Documentation

ROSENWINKEL, J.
Journal of Systems Management, 1981, March, 24-26.

Abstract

Too often, documentation is pushed aside during a systems project, resulting in various problems. Documentation should take place throughout all stages of a project in order to keep track of each new development. It is suggested that companies establish a documentation support group to assist project teams in documenting their systems. The duties of the support group would include such things as helping to determine documentation needs, devising a method to control documentation, monitoring the success in maintaining documentation standards, dissemination of new ideas. The cost and effort involved in setting up such a group is seen as justified in light of its benefits.

3P, OR

Comments

This is not written with user manuals specifically in mind, but the ideas are still useful. The importance of documenting a system as it is developed rather than after it is developed is stressed.

Entry Number 128

Key Words

readability
EEffects Of Readability Of Context Passages On
Subsequent Inspection Rates

ROTHKOPF, E. and Coatney, R.
Journal of Applied Psychology, 1974, 59(6), 679-682.

Abstract

Nineteen paragraphs of text were prepared in a standard and a difficult version using the Flesch Reading Ease Formula. Two experiments were conducted. In the first, 23 subjects saw all 19 paragraphs in the standard version, and 23 subjects saw the first 10 paragraphs in the difficult version and the last 9 paragraphs in the standard version. In the second experiment, 23 subjects saw the complete difficult version and 23 subjects saw 10 standard and 9 difficult paragraphs. Inspection rate in syllables per minute was measured. It was found that subjects exposed first to the ten difficult paragraphs had lower inspection rates for the final 9 standard paragraphs than did those subjects who read all standard paragraphs.

4P, 11R

Comments

It is interesting that reading a difficult passage was found to slow readers down when they came to an easier passage. It seems that maintaining an appropriate level of readability throughout a document is very important, since a difficult section could affect how later sections were read.

Entry Number 129

Key Words

models, analogies
learning, novices
T

Analogical Process In Learning

RUMELHART, D. E. & NORMAN, D. A.
In Anderson, J. (Ed.) Cognitive Skills and Their
Acquisition. Hillsdale, New Jersey: Erlbaum, 1981,
335-359.

Description

The authors describe their theory of learning in which they see new knowledge as integrated into existing schema. They focus primarily on the creation of new schema and fine tuning of schema, where one way in which schema can be thought of is as a user model of a system. In fact, the authors discuss the use of analogy to create a schema for using a text editor by novices. They indicate that conceptual models should be formed by giving learners analogies based on very familiar concepts which are minimally different from the new domain.

25P, 18R

Comments

While the authors do not make the association, their work in teaching about text editors bears resemblance to the advance organizer literature, both theoretically and in terms of practical considerations. The work being done by Mayer on conceptual models for teaching programming languages is particularly similar. However, Mayer's work is more comprehensive at the present time in providing an excellent link between theory and data, in providing guidelines for developing the material for the conceptual model, and in empirically testing the utility of the material.

Entry Number 130

Key Words

analogies, illustrations
EIllustrations, Analogies, And Facilitative Transfer In
Prose Learning

ROYER, J.M. and Cable, G.W.
Journal of Educational Psychology, 1976, 68(2),
205-209.

Description

Illustrations and analogies have been found to facilitate transfer of learning in a prose learning situation. That is, a difficult passage will be better understood when preceded by an easier passage which provides basic information necessary to comprehend both passages, than if it is given alone. In this study eighty subjects read a first passage classified as abstract with analogies, abstract with illustrations, concrete, abstract without embellishments and control. Each subject then read a second unembellished abstract passage on a subject different from the first passage, but related in basic information. Subjects given the first three treatments which used analogies, illustrations, and concrete terms in the first passage, recalled significantly more from the second passage.

5P, 3R

Comments

This may have application to the structured ordering of information in manuals. Where prose is used, writers may be able to use the principles explained here to prepare text such that particularly difficult abstract information is preceded by an adequate background of concrete information.

Entry Number 131

Key Words

illustrations
 guidelines, manuals
 A, R

The Role Of Illustrations In Reading Comprehension

SCHALLERT, D.L. in Spiro, R., Bruce, B.
 and Brewer, W. (Eds.)
 Theoretical Issues in Reading Comprehension. Hillsdale,
 N.J.: Lawrence Erlbaum Associates, Publishers, 1980.

Description

The arguments for and against the usefulness of illustrations in text are given and the relevant research described. The author supports the view that illustrations can facilitate learning under the appropriate conditions. The use of pictures and text, labelled pictures and pictures alone are discussed. Despite wide differences in methodology in the studies, several conclusions are made. Illustrations are beneficial when: 1) they are a central part of the text, 2) they contain information important to the overall message, and 3) they depict structural relationships mentioned in the text. Illustrations are seen as analogous to metaphors in that they can convey information which would take a large number of words to express literally, or even information that is nearly impossible to state in words. Finally, the author discusses "picture literacy", or how one learns to read pictures.

22P, 52R

Comments

This is a theoretical article, but with its many references it could be used as a starting point for setting up guidelines for the use of illustrations in manuals.

Entry Number 132

Key Words

readability
technical writing
A

The Technical Writer - Readability Formulas And The
Nontechnical Reader

SCHENCK, E.M.

Journal of Technical Writing and Communication, 1977,
7, 303-307.

Description

Technical writers write for both technical and non-technical readers. Editors cannot be relied upon to make technical documents readable by non-technical people, since in the process of editing such material they become too sophisticated, and gradually lose their non-technical perspective. Readability formulas do not provide a simple answer to this problem. It is suggested that the results of readability research be made available to technical writers, and that writers be taught to use the cloze readability measure and the embedded sentence count to assess their writing.

4P, 12R

Comments

This gives some direction to using readability methods for practical purposes. References for all the methods discussed are given.

Entry Number 133

Key Words

documentation project
managing, skills
T

Structured Writing For Software Documentation

SCHORLE, R.A.

Proceedings of the 27th International Technical
Communication Conference, 1980, 1, C-173-176.

Description

The job of writing software documentation can be divided among several persons according to their type and level of skill. These persons can then concentrate their talents on particular phases of document development. Three phases of development are outlined. The analysis phase is performed by a senior writer or documentation analyst, and involves understanding the function and capabilities of the software as described by systems analysts and programmers as well as determining what users need and expect in the document. The design phase involves outlining in detail the document structure, and is carried out by a documentation designer. The writing phase is seen as the "easiest" stage, to be completed by an experienced writer. Of course, senior documentation specialists can complete all three steps themselves, but this system is seen as a more efficient use of skills.

4P, OR

Comments

Writing is allotted a back-row seat in this article, being portrayed as a rather mechanical process of "filling in the blanks" of a structured outline. In any case, those in charge of document writing would do well to consider the ideas presented here.

Entry Number 134

Key Words

readability formulas
TComputer-Aided Readability Measurements

SCHULMAN, N.J.

Proceedings of the 27th International Technical
Communication Conference, 1980, 1, C-101-105.

Description

This article describes a computer program for measuring readability which was developed by General Motors Research Laboratories. Based on the Flesch Reading Ease Index, the program counts syllables, words and sentences, but does have a few problems in doing this completely accurately. Suggestions for the application of the program are given.

5P, 2R

Comments

This program is available in listing form in Fortran or Basic from General Motors in Michigan.

Entry Number 135

Key Words

documentation
standards
ADocumentation StandardizationSILBEY, V.
Data Management, 1979, 32-35.

Description

The need for developing and adhering to standards for documenting computer systems is expressed. The author discusses why such standards are needed and what purposes documentation serves. The standardization process includes assessing the current documentation situation, managing a qualified team who develop the standards, and implementing the standards. References are made to several papers where standards may be found.

4P, 12R

Comments

This paper tends to be a bit unclear in presentation, but offers some interesting general ideas.

Entry Number 136

Key Words

illustrations, adjunct aids
learning, questions
E

A Comparison Of Pictorial And Written Adjunct Aids In
Learning From Text

SNOWMAN, J. and Cunningham, D.J.
Journal of Educational Psychology, 1975, 67(2),
307-311.

Description

Sixty-three undergraduate students read one of 7 forms of a text: questions before each paragraph, questions after, pictures before, pictures after, both before, both after, and neither questions nor pictures (control). The questions were multiple choice in nature, and the pictures were instructions to draw the required answer to the same problems stated in imperative form. The effects of these adjunct aids on factual recall were assessed. Items on the criterion test were divided into two types: "practiced" - questions or directions to draw which had been presented already in the text, and "non-practiced" - items which were new. It was found that: 1) pictures and questions were equally effective; 2) adjunct aids placed after text produced superior recall of non-practiced items; 3) practiced items were recalled better than non-practiced items.

5P, 10R

Comments

Adjunct aids can be placed before, during and after a text, and each position seems to have a different effect on how material is learned. The instructional designer should assess the requirements of the instructional situation in order to choose the appropriate type of adjunct aid and the appropriate position in which to place it.

Entry Number 137

Key Words

manuals, usability

G

User Manuals That Make Sense

SNYDERS, J.

Computer Decisions, 1981, 13(4), 127-186.

Description

Eleven documentation specialists comment on the topic of user manuals. The emphasis is on creating clear, accurate and easy-to-use manuals by addressing both user needs and documentation principles. Several qualities of a good manual are discussed. These include: 1) an awareness of the users' needs, 2) simplification of content, 3) use of appropriate standards, 4) graphics, 5) packaging, and 6) updating. Also discussed are various types of user manuals which address different needs, things to consider when starting to develop a user manual, and documentation situations which call for outside help.

7P, OR

Comments

There are many good hints in here for various aspects of manual production. The specialists interviewed do not agree on every point (e.g. the use of standards), but there is general agreement that there is a lot of bad documentation around, and that efforts must be made to improve the situation. Companies which sell training seminars on producing user manuals in-house are referenced.

Entry Number 138

Key Words

legibility, typography
GThe Visible Word

SPENCER, H.
New York: Hastings House, 1968.

Description

Proposals made over the past century for making printed letters communicate more efficiently are described and illustrated. The author sees a need for legibility researchers and typographers to get together, since both have a common goal. Legibility involves the physical aspects of text production: what style of type is used, what sort of paper and ink are used, how words and sentences are spaced, the length of line, angle of type on the page, etc. There are abundant illustrations given to demonstrate the concepts discussed. A set of guidelines based on the research findings are given. A large bibliography is included.

107P, 464R

Comments

Although the subject matter of this book is dealt with more thoroughly elsewhere (Tinker, 1963) the illustrations in this book are excellent in demonstrating the concepts.

Entry Number 139

Key Words

directions
illustrations
E

How Do Young Adults Read Directions With And Without
Pictures?

STONE, D. and Glock, M.
Journal of Educational Psychology, 1981, 73(3),
419-426.

Description

Ninety university undergraduates used directions to assemble a model loading cart. There were three experimental conditions: illustrations alone, text alone, and illustrations plus text. The information content of both text and drawings was designed to be redundant so that increased comprehension in the text and illustrations condition could not possibly be due to the presence of additional information. It was found that subjects in the text plus illustrations condition performed more accurately on the assembly task. Several possible reasons for this finding are suggested. The authors caution that these results may not be generalizable beyond the particular type of illustration used in this study or beyond this population of subjects.

8P, 15R

Comments

Some interesting theories are presented here. It seems that pictures can play an important part in increasing comprehension, although the reasons for this are not clear.

Entry Number 140

Key Words

skills
writing style
T

Analyzing Technical Style

STRATTON, C.

Technical Communication, 1979, 3rd quarter, 4-9.

Description

The author analyzed articles of his and his students' choosing to determine what factors distinguish writing which is excellent from writing which is just adequate. Shunning readability formulas and authorship attribution studies, he formulated a list of the stylistic attributes of what is considered to be excellent writing, using technical writing textbooks and handbooks and his own experience as guides. The ratings of excellent vs. adequate articles on each of the attributes is shown and discussed. It is suggested that the procedure outlined in this article be used by writers to improve their style.

6P, 4R

Comments

In that readability formulas are meant to be descriptive and not prescriptive, this procedure for analyzing style may more useful than formulas to those who wish to improve their writing.

Entry Number 141

Key Words

illustrations
instructions
E

The Syntax Of Pictorial Instructions

SZLICHCINSKI, K. P. in Kolers, P.,
Wrolstad, M. and Bouma, H. (Eds)
Processing of Visible Language (II). New York: Plenum
Press, 1980, 113-124.

Abstract

Experiments are performed to determine how to represent a sequence of actions in pictorial instructions. To find out how people represent actions pictorially, a number of subjects were asked to draw instructions for operating a switch. The types of drawings were then classified and tested. There were large variations in the accuracy with which other subjects could follow these instructions, indicating that the natural representations are not always easily comprehended.

12P, 32R

Comments

This experiment should be read by anyone who favors replacing words with illustrations. The difficulty in unambiguously indicating the simple throw of a switch is well illustrated.

Entry Number 142

Key Words

Instructions, user needs
G

Telling People How Things Work

SZLICHCINSKI, K.
Applied Ergonomics, 1979, 10(1), 2-8.

Description

Ergonomists are responsible for designing equipment so that its operation will be as self-explanatory as possible. However, there is usually a need for some written instructions to accompany equipment. These instructions must accomplish several things. They must attract the user's attention and maintain it long enough for him to extract the information he needs. The information must be presented in a way that best suits the user. This involves such obvious factors as the complexity of language used and the relative merits of prose and diagrams, but it also involves an understanding of user behaviour (e.g. there is a tendency for people to flip through instructions rather than reading them straight through). Studies on the use of instructions for making international calls are used to illustrate various points.

7P, 6R

Comments

Although the type of instructions used as an example here are much simpler than those required to operate computerized equipment, the problems which emerge and the principles discussed are relevant to the production of manuals.

Entry Number 143

Key Words

skills, technical writing
writing style
G

Effective Writing For Engineers, Managers, Scientists

TICHY, H.J.

New York: John Wiley & Sons, Inc., 1966.

Description

This book is designed for professionals who want to improve their writing skills. Problems which are common to all writers and those which specifically affect scientific/technical writers are discussed. The author presents insightful views into the causes of poor writing, and provides a wealth of suggestions on how to get started writing, how to organize material and how to develop a clear, interesting style. Included are sections on grammar, how to choose words and figures of speech, and how to write good sentences and paragraphs. The final chapter offers advice for editors and supervisors on working effectively with writers.

337P, OR

Comments

There is a short section on writing instructions (pp.302-308) which deals mostly with proper organization of material. However, the book is mostly aimed at informative writing rather than instructive writing. The examples are many and very helpful.

Entry Number 144

Key Words

legibility
production, typography
B, G

Legibility Of Print

TINKER, M.A.

Ames, Iowa: Iowa State University Press, 1963.

Description

This book addresses the question "What typographical factors lead to ease and speed of reading with comprehension?" The author begins by describing methods of measuring legibility. Separate chapters are devoted to style and size of type, length of the printed line, spacing between lines, arrangement of type on the page, kinds of ink and paper, and the layout of formulas and tables. A summary of conclusions based on research findings is given at the end of most chapters. The author provides an annotated bibliography (238 entries) which covers the important works on the subject of legibility prior to 1960.

329P, 238R

Comments

This is a major work on legibility, and most of the conclusions found in it are still valid. It provides a detailed account of the mechanical aspects of producing legible printed material.

Entry Number 145

Key Words

cartoons, illustrations
A, T

Cartoons Can Add Punch To Your Technical Manual

TRIMBLE, J.

Technical Communication, 1976, 1st quarter, 10-11.

Description

The use of cartoons to enhance the communicative quality of technical material is discussed. Cartoons can often express a message more effectively than can plain text, and they are more likely to be read and remembered. Also, they can get an idea across which is not central to the overall theme of the text without disturbing the flow of that text. The author suggests that the writer consider using cartoons when he feels an important message may otherwise be overlooked, or if he is having trouble fitting a message into the text. The importance of communication between the writer and the illustrator is pointed out. Also, the idea of developing a cartoon theme throughout a manual is discussed.

2P, OR

Comments

This brief article was written with maintenance manuals in mind, but the ideas could be applied to user manuals as well.

Entry Number 146

Key Words

diagrams, numbers
EPresenting Information In Diagrams

VERNON, M.

Audio-Visual Communication Review, 1953, 147-158.

Description

This paper looks at the effects of presenting numerical information in diagrams as compared to tables. It had been argued by other researchers that readers would find diagrams easier to comprehend than tables. The author contested this, stating that diagrams are not readily accessible by readers; rather, people must become competent at interpreting them. Types of diagrams assessed include pictograms, graphs and bar charts. It was found that diagrams did not ensure better understanding of numerical information. The author states six general conclusions.

12P, 5R

Comments

This is perhaps one of the earliest statements of the idea that for people to understand diagrams and other illustrations they must become "literate" in their use, just as they must be verbally literate to read text.

Entry Number 147

Key Words

readability formulas

T

Checked Your Fog Index Lately?

VERVALIN, C.H.

IEEE Transactions on Professional Communication, 1980,
PC-23(2), 87-88.

Description

Here is a brief explanation of how to apply the "Fog Index", a measure of readability. How to count sentences and words and enter them in the formula is shown, as well as how to interpret the score.

2P, 4R

Comments

The Fog Index is taken from Gunning's (1952) book. This is just a compact account of how it can be used.

Entry Number 148

Key Words

documentation, evaluation
manuals
T

Quality Control Methods For IBM Computer Manuals

WAGNER, C.
Journal of Technical Writing and Communication, 1980,
10(2), 93-102.

Description

Twelve methods of quality control for written documents being used at several IBM locations are described. Each method is defined, and its advantages and disadvantages pointed out. The methods fall into 2 basic categories: 1) thorough reviews by various people (editors, peers, lead-writers, technical owners, specially-skilled persons) and 2) structured field tests or mechanical tests (manual use, walkthroughs, checklists, user feedback).

10P, OR

Comments

This is a good summary of various ways to assess manuals, and gives some realistic comments about the problems involved with each method.

Entry Number 149

Key Words

integration
organization
RIntegrating Information From Text: An Evaluation of
Current Theories

WALKER, C. H. & Meyer, B. J. F.
Review of Educational Research, 50(3), 1980, 421-437.

Description

Knowledge integration is the incorporation of related facts into comprehensive memory structures. This article examines the research on knowledge integration, particularly in relation to text comprehension. Several theories are described, variables thought to affect integration are presented, and some practical implications of this research literature are given.

17P, 58R

Comments

This area has developed recently with very little work occurring before the 70s. In spite of this very late development, Walker is able to point out some practical implications which are of interest to manual designers.

Entry Number 150

Key Words

numbering systems
 reader characteristics
 A, G

Notes On Transforming Nos. 4 And 5

WALLER, R. in Hartley, J. (Ed.)
 The Psychology of Written Communication, London: Kogan
 Page, 1980.

Description

Two revised papers are given here. The first paper deals with numbering systems. Numbering systems provide a means of reference in a text, and often indicate the relative status of information (i.e. subsections). All too often, numbering systems are poorly constructed, thus misleading the reader rather than helping him see the structure of the text. Guidelines for how to employ numbering systems, where to place numbers in text, and what kind of numbers to use are given. The second paper discusses factors affecting the quality of educational texts. It is said that quality depends on how well a text is matched with the reader. Thus producers of text should attempt to understand and predict reader needs. Reader characteristics are briefly discussed.

15P, 7R

Comments

The first paper is of most practical use. As well as conveying information about numbering systems, it acts as an illustration of another interesting device. All paragraphs have to the left of them short phrases summarizing the paragraph content, which when read consecutively provide a quick and simple version of the entire paper's content.

Entry Number 151

Key Words

visual cueing
ATypographical Access Structures For Educational Texts

WALLER, R.H. in Kolers, P., Wrolstad, M.
and Bouma, H. (Eds.)
Processing of Visible Language (I). New York: Plenum
Press, 1979.

Description

Typographic "signalling" of summaries, contents lists, headings, etc. is used in education texts to display structural relations in the content. Readers are thus enabled by such an access structure to select information relevant to their concerns more easily. However, research on the components of access structures has progressed very little and has not provided any practical guidelines. Evidence that people do use selective reading strategies is given. Research methods for conducting real-world studies on access structures are outlined. It is suggested that this research should not only describe the effects of access structures on learners, but also provide usable techniques for constructing beneficial access structures.

13P, 36R

Comments

This is a good, down-to-earth view of where research on access structures should be headed, and how research in general should be geared more towards yielding practical guidelines.

Entry Number 152

Key Words

documentation
guidelines, models
G, T

A Guide For Software Documentation

WALSH, D.

New York: Advanced Computer Techniques Corp., 1969.

Description

This book contains a set of models to be used as guides to writing pleasing, useful documents. The models are designed to relieve the writer of the task of organizing his material and to help him write in a style suitable to his audience. Both reader and writer are said to benefit from the models in that no necessary information is left out and the material is well organized and written at an appropriate level. The models are meant to free the writer for more creative aspects of writing. Fourteen models are provided, including users' guide models. Each model provides a detailed table of contents followed by guidelines on what information to include under each section and how to communicate this information effectively. The author states that the models are not to be used inflexibly, but rather as fundamental guides which should be altered as necessary.

157P, OR

Comments

These models may be somewhat outdated in light of modern computer equipment but could perhaps be revised to suit present needs. In any case, the writer is still responsible for determining the needs and characteristics of his audience, and for choosing an appropriate model and using it wisely.

Entry Number 153

Key Words

persuasion
technical writing, user needs
A

Science, Rhetoric And The Service Manual

WALTERS, F.

Proceedings of the 27th International Technical
Communication Conference, 1980, 2, W-101-108.

Description

Service manuals tend to be written using logical, correct, objective language which focusses on the equipment and not on the reader. This dry, impersonal style of communication is said to be the result of a split between science and rhetoric which took place due to the influence of logical positivism. The author suggests a marriage of science and rhetoric in the realm of technical communication. Persuasion is an important aspect of technical communication and should be employed. The author suggests that manuals be written in a personal style: the reader should be referred to as "you", and he should be given interesting information (e.g. anecdotes) to keep his attention and motivate him to continue. Manuals can focus on the reader instead of the equipment and still remain clear and concise.

8P, OR

Comments

This article should be read in combination with Buehler (1980), which deals with the need for editors to employ a rhetorical approach in their work.

Entry Number 154

Key Words

passive voice
writing style
B

The Passive Voice Verb: A Selected Annotated
Bibliography

WARREN, T.
Journal of Technical Writing and Communication, 1981,
11(3), 271-286 (Part I); 11(4), 373-389 (Parts II-V).

Description

There is a long-standing argument among writers and editors about whether the passive voice should be avoided in favor of the active voice. This bibliography reviews references dealing with this topic from style manuals, technical writing books, research articles, linguistics papers and grammar texts. Part I covers the linguistics material while Parts II-V cover the other areas mentioned above.

16P, 51R (Part I); 17P, 64R (Parts II-V)

Comments

This is included in this bibliography not primarily because it deals with the active/passive argument but because it is a rich source of references to recent writing guides and style manuals.

Entry Number 155

Key Words

algorithms
logical trees
G, T

The Algorithm Writer's Guide

WHEATLEY, D.M. and Unwin, A.W.
London: Longman Group Ltd., 1972.

Description

This book provides detailed instructions on how to construct algorithms or logical trees. Steps are provided for collecting information and organizing it into the most logical and compact sequence of questions. The reader is invited to work through some examples to gain practical experience. Various problems which may be encountered in writing algorithms are discussed, and methods for orderly layout and visual design are given. There are good discussions of uses for algorithms and common objections to their application.

129P, OR

Comments

If you know nothing about algorithms this is a good place to start, and if you are already writing them you still might find some helpful hints here.

Entry Number 156

Key Words

flowcharts, manuals
tables, usability
T

A New Look At Procedures Manuals

WIEDMAN, T. and Ireland, F.
Human Factors, 1967, 7, 371-377.

Description

It is argued that procedures manuals should be designed to reflect the user's actual work situation and that the user should be shown the meaning of his interactions with a system. Such a manual will help the user understand his job and prepare him to operate in a problem-solving manner when necessary. In many manuals it is necessary to wade through a great deal of text to find out how to deal with an operating problem. This article describes a system of displaying solutions to common operating problems in tables and flow charts so that they may be more easily accessed.

7P, OR

Comments

This paper advocates a "glass box" approach to user instruction, i.e. explaining to the user how his actions affect the operation of the system he is using. Several researchers believe that such an approach leads to greater independence in the user.

Entry Number 157

Key Words

evaluation
manuals, usability
T

Testing: How To Increase The Usability Of Computer
Manuals

WINBUSH, B. and McDowell, G.
Technical Communication, 1980, 4th quarter, 20-22.

Description

This paper describes a procedure for testing the usability of computer manuals. Test coordinators must do several things to develop a testing strategy for a particular manual. They must find out who the manual is being written for, and what tasks these users should be able to complete after reading the manual. Test subjects should be chosen to match the actual user group on education and experience. Then, the test coordinators must select the most appropriate methods for testing the manual. Various methods are described. A system for evaluating and applying the test results is outlined.

3P, OR

Comments

There are some good ideas presented here, but they are not very detailed.

Entry Number 158

Key Words

research, technical writing
usability
A, R

Behavioral Research And The Technical Communicator

WRIGHT, P.

Technical Communication, 1978, 2nd quarter, 6-12.

Description

The author states that the results of research on the design of written information do not often enough make their way into practical application. This article describes the results of several studies which looked at verbal explanations, tabulated numerical information and instructions for operating appliances. The emphasis of the discussion is on the overall comprehensibility of technical communication, that is, how quickly and easily the information can be read and understood. The section on verbal explanations looks at the merits of prose vs. alternate formats (logical trees, short sentences and tables). Factors discussed under tabulated numerical information include making "more than / less than" decisions from a table, explicitness and completeness of information and effect of table structure on how well cells can be located. Under instructions, the use of positive vs. negative wordings is discussed. In conclusion, the author states that researchers must stop "conveniently" avoiding practical aspects of communication which are important to technical communicators.

7P, 4R

Comments

This is essentially a review of the author's research findings, which are published elsewhere. She restates her commitment to striving for overall usability in written information.

Entry Number 159

Key Words

task analysis
technical writers, skills
A

Five Skills Technical Writers Need

WRIGHT, P.

IEEE Transactions on Professional Communication, 1981,
PC-24, 1, 10-16.

Description

Technical writing involves mastering more than just writing skills. The author suggests that technical writers must be able to: 1) analyze how readers will use a document, 2) explain difficult concepts in simple terms, and be able to communicate information in formats other than prose, 3) use graphic and typographic aids properly, 4) interpret research findings and apply them to their own needs, and 5) manage the production of the document. Each of these skills is discussed at some length.

7P, 21R

Comments

It may be unlikely to find all these skills embodied in one technical writer. However, a technical writing team could perhaps be built around such qualifications.

Entry Number 160

Key Words

format, illustrations
user needs
G, R

Presenting Technical Information: A Survey Of Research
Findings

WRIGHT, P.

Instructional Science, 1977, 6, 93-134.

Description

This is a fairly broad review of the research which has been done on presenting technical information. Different reader needs and objectives are considered. Alternatives to prose (flow charts, tables, graphs), and the use of illustrations and headings are discussed. Suggestions are given for writing technical information so that it can be both understood and remembered. The author concludes that there are no hard and fast rules which apply to all situations, but there are some fairly well-established findings which can be translated into useful general guidelines.

42P, 101R

Comments

This ties together a lot of research but doesn't offer much depth. It could be a good starting point for those who want a general picture of the research findings. There is an extensive list of references as well.

Entry Number 161

Key Words

instructions, skills
technical writers, usability
A, G

"The Instructions Clearly State ..." Can't People Read?

WRIGHT, P.

Applied Ergonomics, 1981, 12(3), 131-141.

Description

Many people do not use the instructions that accompany equipment, preferring to learn by trial and error. To a great extent, problems inherent in instructions serve to reinforce this lack of use. Information which is inaccurate, poorly structured or hard to understand is viewed as more of a hindrance than a help. The author offers suggestions for alleviating these three problems. Six skills which a technical writer or a team of writers should possess are described in detail. A long list of references is included.

11P, 57R

Comments

This has all the information from Wright (1981) plus some techniques for pilot testing drafts of documents.

Entry Number 162

Key Words

documentation, usability
A, T

Usability: The Criterion For Designing Written
Information

WRIGHT, P. in Kolars, P., Wrolstad, M.
and Bouma, H. (Eds.)
Processing of Visible Language (II). New York: Plenum
Press, 1980, 183-205.

Description

The advantages of taking a "usability" approach to document design are set forth. Usability is said to be a more integrative approach than others which look at only one aspect of design (e.g. readability). The usability approach attempts to take into account reader characteristics, reading purpose, the constraints upon how the document is to be used on the job, and characteristics of the text. Suggestions for achieving usability by assessing these four areas are given, using the example of health care manuals in the third world.

23P, 93R

Comments

Most of these ideas are discussed by various other writers, but not all in the same article. This brings the ideas together to form an "ecologically valid" approach to manual design. There are lots of references.

Entry Number 163

Key Words

format
logical trees, tables
G

Writing To Be Understood: Why Use Sentences?

WRIGHT, P.
Applied Ergonomics, 1971, 207-209.

Description

Sometimes information can be better relayed in formats other than prose. Alternative formats are introduced, including logical trees (flow charts), short sentence lists, and tables. Factors which should be considered when choosing a format are discussed. General guidelines for choosing a format to suit the situation are given.

3P, 12R

Comments

This summarizes the results of Wright and Reid (1973), which had been completed at the time but not published.

Entry Number 164

Key Words

layout, tables
guidelines
G, R

Presenting Information In Tables

WRIGHT, P. and Fox, K.
Applied Ergonomics, 1970, 1(4), 234-242.

Description

This is a comprehensive and fairly detailed summary of the important research findings in the area of table design. The principles underlying the construction and layout of tables are discussed and illustrated. The development by the authors of a conversion table used by the British public during England's conversion to decimal currency in the early seventies is described. A set of very practical guidelines sums up the article.

9P, 7R

Comments

This has a lot of useful information about tables and how to make them optimally usable. The illustrations are quite helpful.

Entry Number 165

Key Words

algorithms
format, tables
E

Written Information: Some Alternatives To Prose

WRIGHT, P. and Reid, F.

Journal of Applied Psychology, 1973, 57, 160-166.

Description

Sixty-eight subjects were presented fictitious information in one of four ways: prose style, flow chart, list of short sentences, two-dimensional table. They then answered some problems with the information in front of them and some problems from memory. Each presentation style was found to yield faster, more accurate processing depending on the difficulty of the problem, and whether or not the subject was working from memory. Explanations for the differential effectiveness are suggested.

7P, 15R

Comments

This is an often-referenced paper. There is a lot of important ideas in here about format and about which types suit particular learning situations.

Entry Number 166

Key Words

instructions
style
E

When Two "No's" Nearly Make A "Yes" - A Study Of
Conditional Imperatives

WRIGHT, P. and Wilcox, P. in Kolers, P., Wrolstad, M.
and Bouma, H. (Eds.)
Processing of Visible Language (I). New York: Plenum
Press, 1979.

Description

This study assessed how well negative instructions are used. Subjects were asked to use instructions to carry out various tasks, and their performance was assessed. Three types of instructions were compared: 1) no negatives (positive wording), 2) one negative ("not" or "unless") and 3) two negatives (both "not" and "unless"). It was found that positive instructions always led to better performance than instructions with negatives in them. Double negatives were no worse than single negatives, and depending on the situation, double negatives were better than single negatives.

18P, 12R

Comments

Here is another addition to the controversy about negative vs. positive statements. The look at double negatives makes this particularly interesting.

Entry Number 167

Key Words

models, calculators
user, design
advance organizers
A, E

The Machine Inside The Machine: Users' Models Of
Pocket Calculators

YOUNG, R. M.

International Journal of Man-Machine Studies, 15, 1981,
51-85.

Description

For an interactive device to be satisfactory, its intended users must be able to form a "conceptual model" of the device which can guide their actions and help them interpret its behaviour. Three designs of pocket calculators are analyzed for the models implied by their behaviour. Two different kinds of user models are illustrated. One type focuses on indicating how the registers of the calculator are affected by various operations, while the other relates the actions performed by the user and the result obtained by the calculator. Direct use of the register models was not useful in explaining some aspects of the calculators to the users, due to complexities in the calculator designs. It is suggested that the ability to present a simple, consistent conceptual model to the user should be considered at the design phase.

25P, 12R

Comments

The recent interest in measuring and providing models for users of calculators is reflected in this article. The authors use the term 'cover story' to describe what Mayer and others call advance organizers. Their register models are similar to Mayer's transactions except that they make no attempt to make their models concrete.

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